TRW NOTE NO. 74-FMT-947

(NASA-CR-147450) USER'S MANUAL FOR THE SHUTTLE ELECTRIC POWER SYSTEM ANALYSIS COMPUTER PROGRAM (SEPS), VOLUME 2 OF PROGRAM DOCUMENTATION (TRW Systems Group) 143 p HC $6.00 CSCL 09C G3/20

N76-18228

Unclas

14601

SHUTTLE

TASK JSC/TRW 542

USER'S MANUAL FOR THE SHUTTLE ELECTRIC POWER SYSTEM ANALYSIS COMPUTER PROGRAM (SEPS)

VOLUME II OF PROGRAM DOCUMENTATION

JUNE 1974

Prepared For
MISSION PLANNING AND ANALYSIS DIVISION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHNSON SPACE CENTER
HOUSTON, TEXAS
NAS 9-13834

Prepared by: R. W. Bains
H. A. Herwig
J. K. Luedeman
E. M. Torina

Approved by
W. B. Warren, Acting Manager
Electronic Systems
Engineering Department

Approved by
R. A. Mintz, Head
Electric Power Section

Approved by
D. M. Austgen, Manager
Mission Trajectory Control
Program

ABSTRACT

The Shuttle Electric Power System Analysis Computer Program (SEPS) was developed by TRW under JSC/TRW Task 542 for the Consumables Analysis Section of the Mission Planning and Analysis Division. The SEPS program has two major uses; first, to perform detailed load analysis including predicting energy demands and consumables requirements when the Shuttle electric power system is operated and perturbed in accordance with premission flight plans; and second, to perform parametric and special case studies on the Shuttle electric power system. As an additional feature, the SEPS program can be and has been used to analyze the ASTP Apollo electric power system. No program changes are required to use the SEPS program for analysis of the ASTP Apollo electric power system.

The SEPS Computer Program is written in FORTRAN V for use on the UNIVAC 1108 under the EXEC II operating system.

Documentation of the SEPS program is divided into two separate volumes:

VOLUME I - PROGRAM MANUAL

Contains descriptions of each major subroutine of the SEPS program including functional flow diagrams.

VOLUME II - USER'S MANUAL

Contained herein.

TABLE OF CONTENTS

Section		Page
	ABSTRACT	iii
	TABLE OF CONTENTS	v
	LIST OF TABLES	ix
	LIST OF FIGURES	xi
1.0	INTRODUCTION	1
2.0	SEPS PHASE I	5
	2.1 DISCUSSION	5
	2.2 DATA BASE	5
	2.2.1 Component Data	5
	2.2.2 Procedure Data	8
	2.2.3 Activity Data	11
	2.2.4 Switch Data	11
	2.2.5 Cyclic Data	12
	2.3 TIMELINE	12
	2.3.1 Source	12
	2.3.2 Construction	12
	2.3.3 Utilization	13
	2.4 FORMATTED PRINTOUT DESCRIPTION	13
	2.5 PLOT TAPE	21
	2.6 PHASE I INTERFACE TAPE	29
3.0	SEPS PHASE II	31
	3.1 DISCUSSION	31
	3.2 PHASE II INPUT DATA	33
	3.2.1 Circuit Definition	33

TABLE OF CONTENTS (CONTINUED)

Section		Page
	3.2.1.1 Circuit Elements	33
	3.2.1.2 Distribution Circuit Description	34
	3.2.1.3 Simple Circuit	34
	3.2.1.4 Circuit Input Data	36
	3.2.2 Variable Data	45
	3.3 CARD TIMELINE DATA INPUT	45
	3.4 FORMATTED PRINTOUT DESCRIPTION	58
	3.4.1 DC Distribution Network Status	58
	3.4.2 Source Status and Cryogenic Usage	58
	3.4.3 Constraint Analysis Printout	63
	3.4.4 Phase II COMUSE Printout	63
	3.5 PLOT TAPES	63
	3.6 PHASE II INTERFACE TAPE	63
4.0	PHASE I/PHASE II RUN PROCEDURES	67
	4.1 PROGRAM OPTION CARDS	67
	4.2 PHASE I DECK SETUP	67
	4.2.1 Tape Assignments	67
	4.2.2 CUR	75
	4.2.3 WLCCIT	75
	4.2.4 JVMMPS	75
	4.2.5 SEPS	75
	4.3 DECK SETUP FOR PHASE II RUN AND PHASE I/PHASE II RUNS	76
	4.3.1 Tape Assignments	80
	4.3.2 CUR	81
	4.3.3 WLCCIT	81

TABLE OF CONTENTS (CONTINUED)

Section		Page
4.3.4	JVMMPS	81
4.3.5	SEPS	81
APPENDIX A		A-1
APPENDIX B		B-1
APPENDIX C		C-1
APPENDIX D		D-1
APPENDIX E		E-1
APPENDIX F		F-1
APPENDIX G		G-1

LIST OF TABLES

Table No.		Page
2-1	COMPONENT DEFINITION CARD	6
2-2	PROCEDURE/ACTIVITY ELEMENT DEFINITION CARDS	9
2-3	TIMELINE CARD FORMAT	14
2-4	CYCLIC TIMELINE CARDS	15
2-5	EXAMPLE OF MISSION PHASE ACTIVITY	16
2-6	LOAD SUMMARY TABLE	18
2-7	ACTIVE COMPONENTS AT THE END OF MISSION PHASE	19
2-8	POWER VERSUS TIME GRAPH	20
2-9	ACTIVE COMPONENTS UPON COMPLETION OF MISSION	22
2-10	COMPONENT ACTIVATION LIST	23
2-11	SUBSYSTEM/MISSION PHASE ANALYSIS	24
2-12	COMPONENT USAGE LISTED BY DECREASING PERCENT OF ENERGY USED	25
2-13	SUBSYSTEM USAGE SUMMARY	26
2-14	SUBSYSTEM SUMMARY BY MISSION PHASE	27
2-15	SEPS PHASE 1 PLOT TAPE	28
3-1	INPUT DATA VARIABLES FOR PHSE II	46
3-2	PLOT PARAMETERS	65
3-3	ASTP PLOT PARAMETERS	66
4-1	OPTION CARD FORMAT	68
4-2	UNITS CARD FORMAT	71
4-3	ABORT CARD	73
4-4	MISSION PHASE CARD(S)	77

LIST OF FIGURES

Figure No.		Page
1-1	FUNCTIONAL FLOW DIAGRAM	2
3-1	INPUT/OUTPUT FLOW DIAGRAM OF SEPS PHASE II	32
3-2	SIMPLE CIRCUIT	35
3-3	BRANCH/NODE/ELEMENT CONFIGURATION OF SIMPLE CIRCUIT . . .	37
3-4	CIRCUIT DEFINITION DECK SETUP	38
3-5	CARD DATA (FREE FIELD FORMAT)	39
3-6	INPUT CARD LISTING - EXAMPLE	41
3-7	INITIALIZATION DECK SETUP	56
3-8	INITIALIZATION DATA CARD LISTING - EXAMPLE	57
3-9	CARD TIMELINE DECK SETUP	59
3-10	CARD TIMELINE DATA LISTING - EXAMPLE	60
3-11	DC DISTRIBUTION NETWORK STATUS	61
3-12	SOURCE AND INVERTER STATUS, AND CRYOGENIC USAGE	62
3-13	CONSTRAINT ANALYSIS PRINTOUT	64
4-1	OPTION CARD LISTING - EXAMPLE	74
4-2	COMPLETE DECK SETUP FOR PHASE II OR PHASE II WITH PHASE I INTERFACE TAPE RUN	78
4-3	LISTING OF TAPE ASSIGNMENT, CUR OPER., AND XQT SEPS CARDS	82
4-4	BUILD NEW DATA FILE WITH CIRCUIT DESCRIPTION INPUT . . .	83

1.0 INTRODUCTION

1.0 INTRODUCTION

This User's Manual defines how to use the SEPS Program.

Figure 1-1 depicts the functional flow diagram of the SEPS Program. SEPS consists of two major parts referred to as Phase I and Phase II. Phase I converts a mission event timeline into an electrical load profile and Phase II provides distribution circuit and power source operating points as a function of electrical loading and equipment parameters.

Section 2 defines SEPS Phase I data base requirements and formats, procedure and activity definitions, and mission timeline input formats.

Section 3 defines SEPS Phase II distribution circuit input and fixed data requirements.

Section 4 defines run procedures and deck setups for Phase I, Phase II, and combined Phase I/Phase II runs.

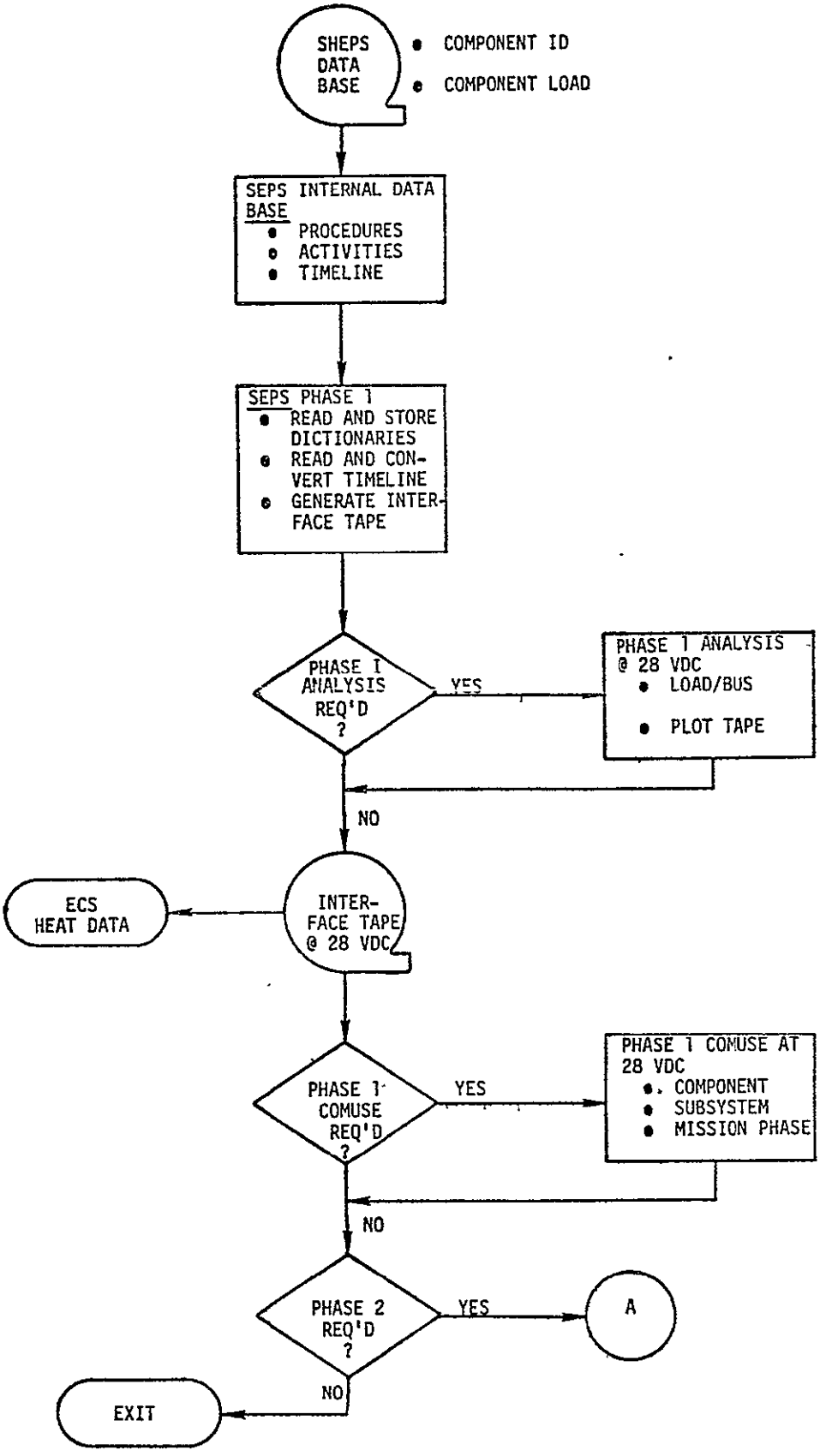


FIGURE 1-1. FUNCTIONAL FLOW DIAGRAM

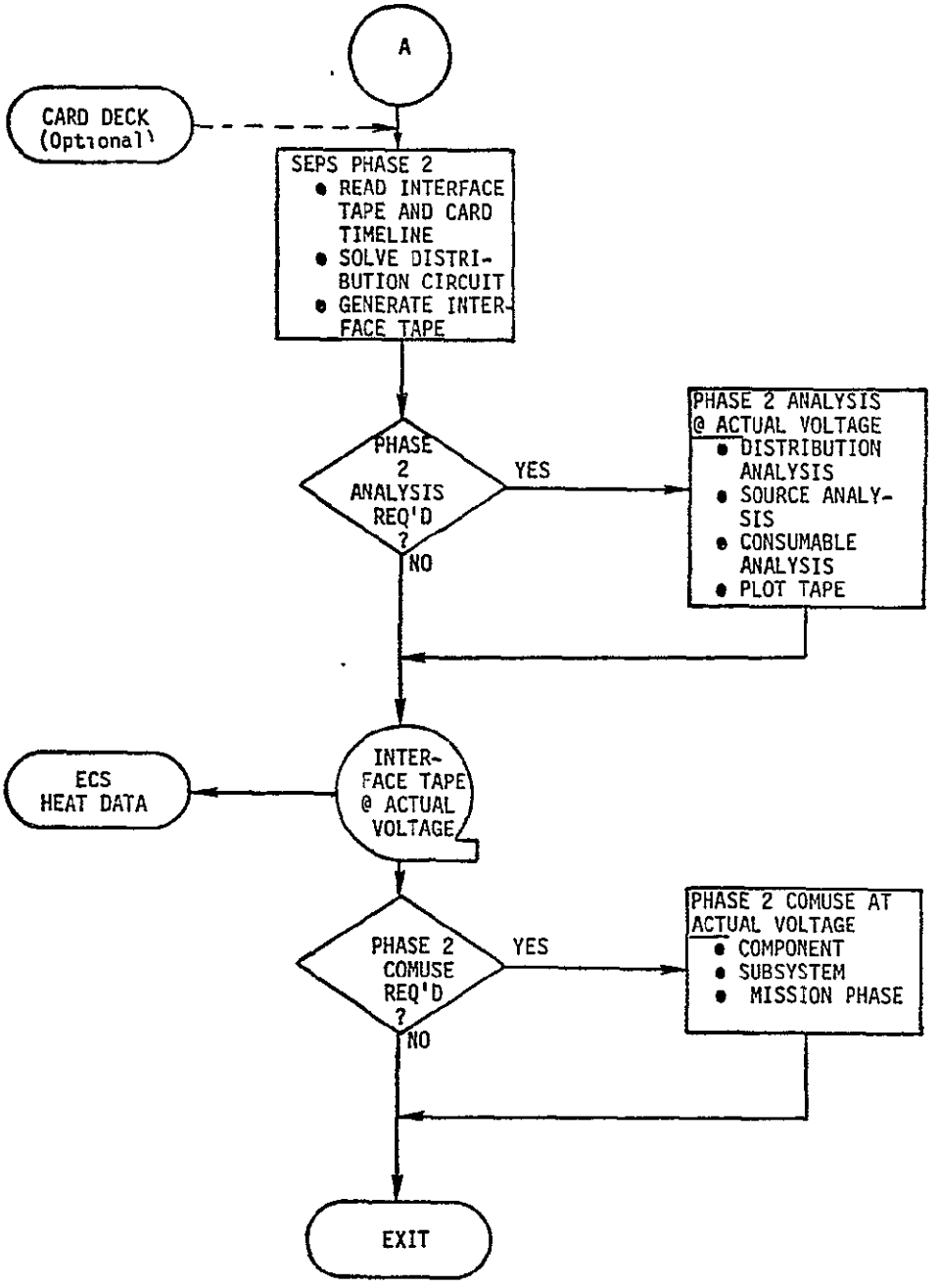


FIGURE 1-1. FUNCTIONAL FLOW DIAGRAM (CONTINUED)

2.0 SEPS PHASE I

2.0 SEPS PHASE I

2.1 DISCUSSION

The SEPS Computer Program Phase I converts a mission event timeline to an electrical load profile and provides subsystem and mission analyses of the power and energy demands for Shuttle missions. The analysis is based on a 28 VDC load bus voltage. The program utilizes a data base which describes all Shuttle electrical power consuming equipment in terms of power requirements and relating all the equipment to subsystems. This data combined with a desired mission event timeline provides the basis for the output interface tape consisting of event time point data and a listing of the activated components. The interface tape is utilized as the input driver for the Phase I COMUSE analyses and Phase II. The Phase I COMUSE analyses include the end of mission component, subsystem, and mission phase loads and energy summaries. The Phase I COMUSE analyses are discussed in Section 2.4 (FORMATTED PRINTOUT DESCRIPTION). Phase II utilization of the interface tape is discussed in Section 3.0 (PHASE I/PHASE II INTERFACE).

2.2 DATA BASE

2.2.1 Component Data

Data utilized to construct the component dictionary for the SEPS data base was obtained from the Master Electrical Equipment List furnished by Rockwell through JSC. The following characteristics of each component were used:

1. ID# - 1st two digits : Subsystem ID
   2nd two digits : Rockwell ID
   3rd two digits : Component Mode
2. Component Title
3. AC or DC designation (if available)
4. Power value

These were combined with a load assignment. Then, to make the data complete, a power factor was assigned. These all combined make up the data for the component portion of the data base. Refer to Table 2-1 for the punched card format of this data.

TABLE 2-1. COMPONENT DEFINITION CARD

COMPONENT DEFINITION CARD (1 PER COMPONENT)

THE FORMAT OF THE COMPONENT CARDS IS AS FOLLOWS.

COLUMN	TYPE	DEFINITION
1	ALPHA	'C' INDICATES THE COMPONENT DEFINITION CARD
2	INTEGER	MODE
3	BLANK	NOT USED
4-9	INTEGER	COMPONENT ID NUMBER
10-11	INTEGER	LOAD NUMBER
12-13	BLANK	NOT USED
14-43	ALPHA	COMPONENT TITLE
44	BLANK	NOT USED
45-49	REAL	POWER FACTOR $\leq$1.
50-56	REAL	POWER CONSUMED @ 24. VDC
57-63	REAL	POWER CONSUMED @ 28. VDC
64-70	REAL	POWER CONSUMED @ 32. VDC
71-80	NOT USED	

The SEPS computer program has the capability to handle a maximum of 50 DC (or DC equivalent) load assignments and 9 inverters. The load numbers of 1 through 50 have been reserved for DC or DC equivalent loads. Load numbers 52 - 54 have been reserved for 3ϕ AC loads. Load numbers 61-69 have been reserved for 1ϕ AC loads.

The SEPS AC load number grouping is as follows:

Load Number	Type of Load	Bus Assignments
52	3 ϕ AC	AC #1
61	1 ϕ AC	AC #1
62	1 ϕ AC	AC #1
63	1 ϕ AC	AC #1
53	3 ϕ AC	AC #2
64	1 ϕ AC	AC #2
65	1 ϕ AC	AC #2
66	1 ϕ AC	AC #2
54	3 ϕ AC	AC #3
67	1 ϕ AC	AC #3
68	1 ϕ AC	AC #3
69	1 ϕ AC	AC #3

The DC equivalent load for the AC components are specified by the assignment of a particular load number and branch location in the circuit definition. The circuit definition description is contained in Section 3.2.1.

2.2.2 Procedure Data

Procedures are collections of components grouped together for a specific function. For example, those components having to do with G&N at lift-off would be included in the same procedure.

The data required for a procedure is organized in the following manner. The procedure is assigned a unique number and title. The numbers are similar for procedures with similar functions; e.g.:

P110 G&N Baseline A (LO to LAND)
P111 G&N Baseline B (LO to LAND)
P120 NASA Comm
P121 NASA Comm
P125 USAF Comm

The corresponding component data follows the procedure number and title card. This data includes:

1. "Call" designation - e.g., "CP" - Component called from a procedure
2. Component Number
3. Start Time: component "start" time can be "delta"-ed to start either before* or after** the component is actually called from timeline.
4. Stop Time: same "delta" situation exists for stop time as for start time. Stop time cannot be 00000.
5. Use Factor: component is "ON" % of designated time period
6. Component Title
7. Procedure ID: solely convenience feature to designate which procedure a component belongs to when in card form.

Refer to Table 2-2 for procedure card format.

*NOTE 1: Signified by - sign preceding time delta on card
**NOTE 2: Signified by + sign preceding time delta on card

TABLE 2-2. PROCEDURE/ACTIVITY ELEMENT DEFINITION CARDS (2 PER ELEMENT)

THE FORMATS OF THE PROCEDURE/ACTIVITY CARDS ARE AS FOLLOWS

CARD 1

COLUMN	TYPE	DEFINITION
1	ALPHA	A INDICATES ACTIVITY DEFINITION
		P INDICATES PROCEDURE DEFINITION
2	BLANK	MUST BE BLANK
4-10	INTEGER	P/A ELEMENT NUMBER
12-47	ALPHA	TITLE (UP TO 36 CHARACTERS)

CARD 2

1-2	ALPHA	CP - COMPONENT CALLED FROM A PROCEDURE
		CA - COMPONENT CALLED FROM AN ACTIVITY
		PA - PROCEDURE CALLED FROM AN ACTIVITY
		SP - SWITCH CALLED FROM PROCEDURE
		SA - SWITCH CALLED FROM ACTIVITY
3		Y - (if cyclic card)
4-10	INTEGER	COMPONENT NUMBER IF COLUMN 1 = C
		PROCEDURE NUMBER IF COLUMN 1 = P
		IF COLUMNS 9 AND 10 = 00 THEN ALL COMPONENTS WHOSE FIRST 5 DIGITS AGREE WITH COLUMNS 4-8 WILL BE READ IN
11		MODE
12-17	INTEGER	START TIME IN HHHMM (PLUS OR MINUS)*

*NOTE: This designation explained in more detail in formal write-up section on Procedure/Activity Cards.

TABLE 2-2. PROCEDURE/ACTIVITY ELEMENT DEFINITION CARDS (CONTINUED)

THE FORMATS OF THE PROCEDURE/ACTIVITY CARDS ARE AS FOLLOWS

CARD 2 (CONTINUED)

COLUMN	TYPE	DEFINITION	
18-23	INTERGER	STOP TIME IN HHHMM (PLUS OR MINUS)*	
24-28	REAL	USE FACTOR (GE 0. AND LE 100.)	
29-34	R	PERIOD	
35-40	R	DECIMAL FRACTION OF ON TIME	Applicable only to cyclic data cards
41-80		GROUPS OF FOUR COLUMNS (LLLV)** FOR SWITCH. IF NOT SWITCH, TITLE IN THIS SPACE	

*NOTE: Stop time not used if this is cyclic card.

**NOTE: LLL provide spaces for branch where switch is located. V is 1 if switch closed, 0 if switch open.

2.2.3 Activity Data

Activities are collections of procedures and/or components grouped together by "mission phase" considerations. That is, procedures and components grouped together which must be on at a particular time for a specified duration to accomplish a mission objective. E.g.:

A 1000 Prelaunch to Landing - contains all those components and procedures which must be on for entire mission; provides base load.

The Activity data is organized by:

1. Unique number and title
2. Corresponding procedure and component data as in procedure definition.

Refer to Table 2-2 for activity card format.

2.2.4 Switch Data

Phase I has the capability of controlling Phase II electrical power analysis on different circuit configurations obtained through opening or closing switches in the different branches. For example, all loads can be fed by two fuel cells by closing some switches and opening others. The effect of this action on the fuel cell loading can then be analyzed in Phase II.

The following data is required:

1. Card Type - "S" for switch
2. Start Time - when the switch condition should change if not when switch card is "turned on".
3. Stop Time - when the switch condition will change to its opposite state.
4. Switch Location - branch number.
5. Switch Value - 0 for open, 1 for closed.

Refer to Table 2-2 for switch card format.

2.2.5 Cyclic Data

Certain components will actually cycle on and off during a Shuttle mission. Phase I analysis has the capability of simulating this activity through the program. The following data appears on the cyclic cards:

1. Cyclic Identifier - "Y"
2. Type of cyclic action
3. + for begin cyclic action
4. - for end cyclic action
5. Mode
6. Time
7. Period of cycle
8. Decimal fraction of period component is active
9. Title

The cyclic card format is shown in Table 2-2.

2.3 TIMELINE

2.3.1 Source

Data utilized to create the timeline is gathered from two main sources. First, JSC Mission description documentation provides the bulk of the timeline information. From this source it is possible to obtain mission events and durations. Also, timelines for burns and attitude changes are incorporated into the SEPS timeline information to provide more detailed usage data for specific subsystems and components. Second, data from JSC subsystem groups are utilized to construct specific requirements portions of the timeline. E.g., the correct heater and communications equipment usage is obtained by using data from this source.

2.3.2 Construction

As stated above, data from JSC documentation are utilized in forming a chronological sequence of mission events. The SEPS data base activities,

procedures, and components are turned "on" and "off" at the appropriate time according to the sequence. A "plus" sign signifies turn on of the desired entity and a "minus" sign signifies turn off.

The following data appears in the timeline:

1. Timeline entity identifier - tells whether an activity, procedure, or component is affected.
2. "+" or "-": turn on or off, respectively.
3. Entity Number: number of activity, procedure or component affected.
4. Time: MET at which operation occurs.
5. Title: Names activity, procedure or component affected.

Refer to Tables 2-3 and 2-4 for the card formats.

2.3.3 Utilization

Timeline events as constructed are further grouped to be used in larger time blocks. All turn on/off times are "delta"ed to some base time value determined from the mission descriptions. E.g.,

1. LO to Sortie - all operations referenced to zero
2. Sortie to End Sortie - all operations referenced to 51 hours (time at which sortie begins as determined from Mission 2A description).
3. End Sortie to Touchdown - all operations referenced to 149 hours (time at which sortie ops end for Mission 2A).

These can easily be made for any Shuttle mission and can be used to analyze many different options. Refer to Table 2-5 for an example. A program, JVMMPS, to be described later, organizes these blocks to form a proper time sequenced timeline.

2.4 FORMATTED PRINTOUT DESCRIPTION

The formatted printouts available from SEPS Phase I are discussed in subsequent paragraphs and examples of each type of printed output are provided.

TABLE 2-3. TIMELINE CARD FORMAT

THE FORMAT OF THE TIMELINE CARDS IS AS FOLLOWS

COLUMN		PURPOSE
1	T	INDICATES THIS IS A TIMELINE CARD
2	A/P/C/S	INDICATES WHICH TYPE OF OPERATION TO PERFORM
3-9		+ BEGIN OPERATION
		- END OPERATION
		ACTIVITY/PROCEDURE/COMPONENT/SWITCH NUMBER
10		MODE
11-19		TIME IN HHHHHMMSS (PLUS OR MINUS)
20		SPECIAL OPERATION FLAG *
21-33		BLANK
34-69		TITLE

A TIMELINE CARD INITIATES ITS OPERATION AT ITS "START" TIME AND CONTINUES UNTIL ITS "STOP" TIME AT WHICH TIME THE ACTIVE COMPONENTS ARE TURNED "OFF".

*NOTE: If it is desired to turn a component or procedure off in an different way than it was turned on, Column 20 must contain a non zero integer.

TABLE 2-4. CYCLIC TIMELINE CARDS

THE FORMAT OF CYCLIC TIMELINE CARDS IS AS FOLLOWS

COLUMN		PURPOSE
1	Y	INDICATES THIS IS A CYCLIC CARD
2	A/P/C	INDICATES WHAT TYPE OF CYCLIC ACTION
3-9		+ BEGIN CYCLIC FUNCTION
		- END CYCLIC FUNCTION
		ACTIVITY/PROCEDURE/COMPONENT NUMBER
10		MODE
11-19		TIME (HHHHHMMSS)
20		SPECIAL OPERATION FLAG *
21-25		PERIOD OF THE CYCLE GIVEN IN DECIMAL HOURS
26-30		DECIMAL FRACTION OF THE PERIOD THE ACTION IS TO BE TAKEN
31-33		BLANK
34-69		TITLE

A CYCLIC CARD BEGINS ACTION AT ITS "START" TIME AND CONTINUES UNTIL THE CYCLIC COMPONENTS ARE TURNED "OFF". SEE DISCUSSION OF TIMELINE OPERATIONS.

*NOTE: Only if Col. 20 > 0, can components concerned be turned off outside of the procedure/activity through which they are turned on.

TABLE 2-5. EXAMPLE OF MISSION PHASE ACTIVITY

			MISSION 2A OPTION 1 (DT 51)	
TP-	217	0000000	RCS OI TO ENTRY	(OFF)
TP+	114	0140000	STARTRACKER ALIGN W RCS	(ON)
TP+	114	0380000	STARTRACKER ALIGN W RCS	(ON)
TP+	114	0620000	STARTRACKER ALIGN W RCS	(ON)
TP+	114	0860000	STARTRACKER ALIGN W RCS	(ON)
TP-	820	0980000	PAYLOAD OBSERVATION	(OFF)
TP+	217	0980000	RCS OI TO ENTRY	(ON)

Any of the formatted printouts can be selected or omitted for printing at the option of the user. The first six tables are outputs available from SEPS Phase I, the remaining tables are outputs from COMUSE which is driven by the interface tape.

PRINTED OUTPUT

OUTPUT PROVIDED AT EACH LOAD CHANGE

1. Load Summary (Table 2-6) - The Load Summary output occurs whenever a component has cycled ON or cycled OFF. It prints the power level of each subsystem after the component has cycled and the power output required from each fuel cell. The following defines the various sections of the Load Summary output:

   a) The cycled component (equipment) listed with its power definition

   b) Subsystems that presently require power

   c) Ac and dc total load requirements

   d) Fuel cell power required

OUTPUT PROVIDED AT THE END OF EACH MISSION PHASE

1. Active Components at End of Mission Phase (Table 2-7) - This output lists the components that are active at the end of the mission phase. It provides a vehicle electrical component configuration check for verification of subsystems and program status.

OUTPUT PROVIDED EVERY 24 HOURS OF MISSION TIME

1. Power vs Time Graph (Table 2-8) - The graph is printed every 24 hours of elapsed mission time and provides a plot of the electrical power required during that time period. This graph gives a pictorial view of the power levels and what times the peaks and valleys occur.

TABLE 2-6. LOAD SUMMARY TABLE

AT TIME 32.9800 POINT 1307 THE FOLLOWING COMPONENTS HAVE CHANGED CONDITION

	COMPONENT NO.	COMPONENT NAME	LOAD NO.	COLDPLATE NO		LOAD VALUE	ACTIVITY, PROCEDURE OR COMPONENT CALLED	PROCEDURE CALLED	TIME CALLED
a	221501	TANK HTRS-F&D	3001	SWITCHED OFF	0	.0000	-221500	0	32.9800
	221502	TANK HTRS-F.D	13001	SWITCHED OFF	0	.0000	-221500	0	32.9800
	221503	TANK HTRS-F&D	23001	SWITCHED OFF	0	.0000	-221500	0	32.9800
	21101	S-BAND FM XMIT	6101	SWITCHED ON	1	60.0000	21101	0	32.9833
	21201	S-BAND FM SIGNAL PROC	6101	SWITCHED ON	1	6.0000	21201	0	32.9833

REQUIRED OUTPUT AT TIME 32.9800

b	SYSTEM	1	911.4560	SYSTEM	2	514.8000	SYSTEM	3	1017.0076	SYSTEM	4	512.7200
	SYSTEM	5	.0000	SYSTEM	6	556.7640	SYSTEM	7	1703.5199	SYSTEM	8	.0000
	SYSTEM	9	.0000	SYSTEM	15	.0000	SYSTEM	16	.0000	SYSTEM	20	.0000
	SYSTEM	21	.0000	SYSTEM	22	2.3296	SYSTEM	30	403.7883	SYSTEM	31	265.2000
	SYSTEM	32	.0000	SYSTEM	40	2319.1999	SYSTEM	50	27.0400	SYSTEM	51	.0000
	SYSTEM	52	.0000	SYSTEM	0	.0000	SYSTEM	0	.0000	SYSTEM	0	.0000

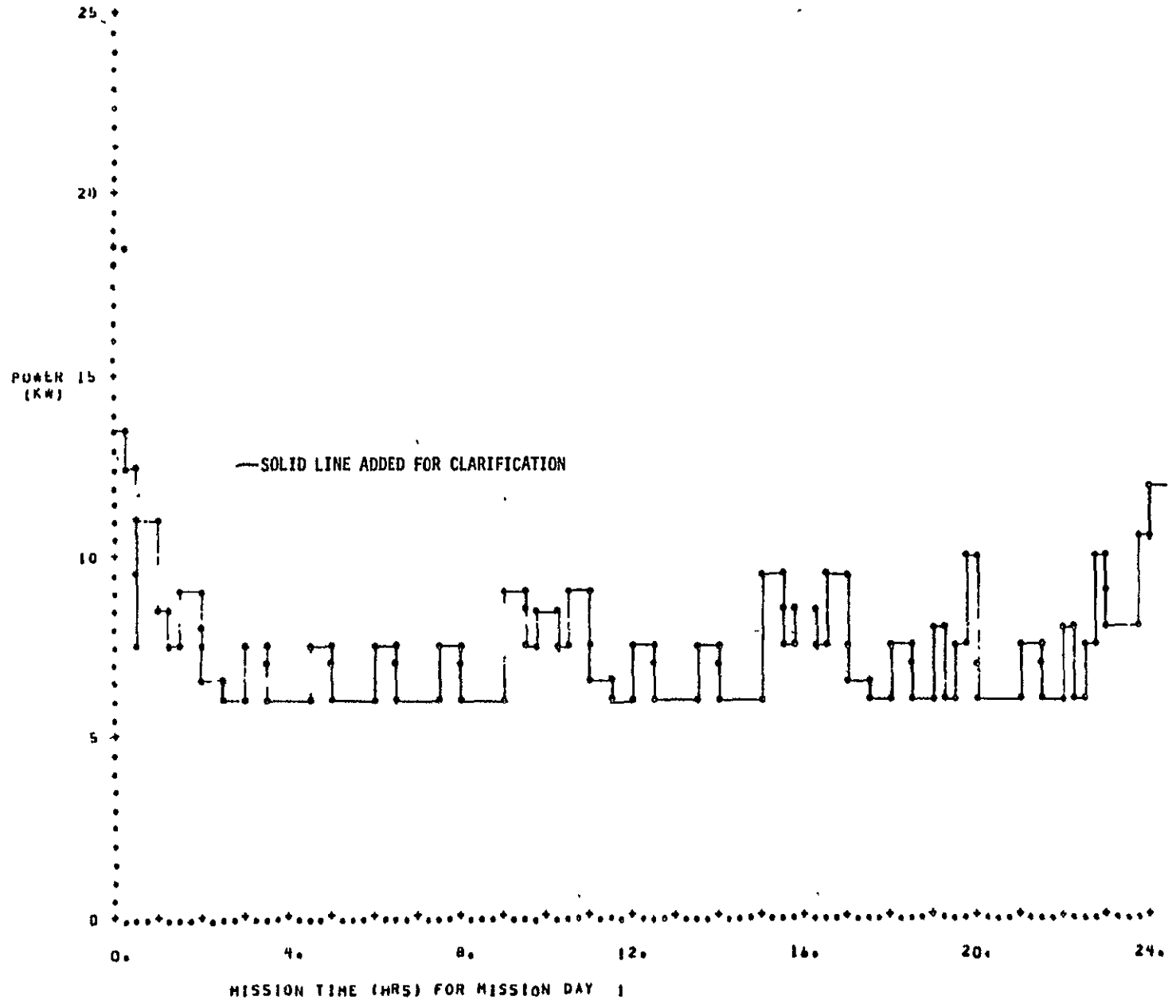
c	TOTAL AC LOAD	2317.3862
	TOTAL DC LOAD	5916.4366
d	TOTAL FUEL CELL REQUIREMENT	8233.8228

TABLE 2-7. ACTIVE COMPONENTS AT THE END OF MISSION PHASE

COMPONENT NO.	COMPONENT NAME	LOADING	COLDPLATE NO.		LOAD VALUES	
10101	IMU		4201	100.00000	185.00000	ACTIVE COMPONENT
10102	IMU		6201	100.00000	185.00000	ACTIVE COMPONENT
10301	STAR TRACKERS		4001	100.00000	15.00000	ACTIVE COMPONENT
10302	STAR TRACKERS		6001	100.00000	15.00000	ACTIVE COMPONENT
10303	STAR TRACKERS		9001	100.00000	15.00000	ACTIVE COMPONENT
10401	BODY RATE SENSOR PKG		4101	100.00000	5.20000	ACTIVE COMPONENT
10402	BODY RATE SENSOR PKG		6102	100.00000	5.20000	ACTIVE COMPONENT
10403	BODY RATE SENSOR PKG		9103	100.00000	5.20000	ACTIVE COMPONENT
10404	BODY RATE SENSOR PKG		4101	100.00000	5.20000	ACTIVE COMPONENT
10405	BODY RATE SENSOR PKG		6102	100.00000	5.20000	ACTIVE COMPONENT
10406	BODY RATE SENSOR PKG		9103	100.00000	5.20000	ACTIVE COMPONENT
11001	OMS TVC DRIVER UNIT		1101	100.00000	9.00000	ACTIVE COMPONENT
11002	OMS TVC DRIVER UNIT		2102	100.00000	9.00000	ACTIVE COMPONENT
11003	OMS TVC DRIVER UNIT		3103	100.00000	9.00000	ACTIVE COMPONENT
20601	AUDIO CENTER		5202	100.00000	20.00000	ACTIVE COMPONENT
20602	AUDIO CENTER		7202	100.00000	20.00000	ACTIVE COMPONENT
20701	SIGNAL PROCESSOR		26201	100.00000	13.00000	ACTIVE COMPONENT
20801	PAYLOAD DATA INTERLEAVER		10101	100.00000	20.00000	ACTIVE COMPONENT
21201	S-BAND MULTIPLEXER		26101	100.00000	.40000	ACTIVE COMPONENT
21202	S-BAND MULTIPLEXER		28102	100.00000	.40000	ACTIVE COMPONENT
21303	S-BAND XCVR (TDRS) REC 2		28102	100.00000	15.00000	ACTIVE COMPONENT
21304	S-BAND XCVR (TDRS) XMIT 2		28102	100.00000	220.00000	ACTIVE COMPONENT
21401	VHF+S-BAND XFER RF SWS		26101	100.00000	8.40000	ACTIVE COMPONENT
22301	USB XPOND REC NASA		26201	100.00000	7.00000	ACTIVE COMPONENT
22302	USB XPOND XMIT NASA		26201	100.00000	21.00000	ACTIVE COMPONENT
22401	VOICE PROCESSOR		26101	100.00000	5.00000	ACTIVE COMPONENT
22402	VOICE PROCESSOR		28102	100.00000	5.00000	ACTIVE COMPONENT
22501	DIGI COMM PROCESSOR		26101	100.00000	40.00000	ACTIVE COMPONENT
22502	DIGI COMM PROCESSOR		28102	100.00000	40.00000	ACTIVE COMPONENT
22601	USB DECODER		26101	100.00000	12.00000	ACTIVE COMPONENT
22602	USB DECODER		28102	100.00000	12.00000	ACTIVE COMPONENT
30102	2 OR 3 AXIS ATT DIR IND		6301	100.00000	25.00000	ACTIVE COMPONENT
31401	QTY IND OMS/RCS		5301	100.00000	6.00000	ACTIVE COMPONENT
31501	CAUT + WARNING UNIT		24301	100.00000	30.00000	ACTIVE COMPONENT
31601	PERF MON ELECT UNIT		29301	100.00000	11.00000	ACTIVE COMPONENT
31701	MISSION TIMERS		4301	100.00000	5.00000	ACTIVE COMPONENT
31702	MISSION TIMERS		6301	100.00000	5.00000	ACTIVE COMPONENT
31802	EVENT TIMERS		7301	100.00000	7.50000	ACTIVE COMPONENT
31901	CRT DISPLAY UNITS		6301	100.00000	60.00000	ACTIVE COMPONENT
31902	CRT DISPLAY UNITS		7301	100.00000	60.00000	ACTIVE COMPONENT
32001	KEYBOARDS		6301	100.00000	15.00000	ACTIVE COMPONENT
32002	KEYBOARDS		7301	100.00000	15.00000	ACTIVE COMPONENT
32101	DISPLAY PROCESSORS		25301	100.00000	120.00000	ACTIVE COMPONENT
32102	DISPLAY PROCESSORS		27301	100.00000	120.00000	ACTIVE COMPONENT
32202	DISPLAY CPLR DR UNITS		27301	100.00000	20.00000	ACTIVE COMPONENT
32402	ROT HAND CONTR		6301	100.00000	3.56400	ACTIVE COMPONENT
33002	CONTRL ENCDR/CPLR UNIT		29301	100.00000	25.00000	ACTIVE COMPONENT
33301	FLT DECK FLOOD LIGHTS		4301	100.00000	1.50000	ACTIVE COMPONENT
33302	FLT DECK FLOOD LIGHTS		5301	100.00000	1.50000	ACTIVE COMPONENT
33303	FLT DECK FLOOD LIGHTS		6301	100.00000	1.50000	ACTIVE COMPONENT
33304	FLT DECK FLOOD LIGHTS		7301	100.00000	1.50000	ACTIVE COMPONENT
33305	FLT DECK FLOOD LIGHTS		8301	100.00000	1.50000	ACTIVE COMPONENT
33306	FLT DECK FLOOD LIGHTS		9301	100.00000	1.50000	ACTIVE COMPONENT
33307	FLT DECK FLOOD LIGHTS		4301	100.00000	1.50000	ACTIVE COMPONENT
33308	FLT DECK FLOOD LIGHTS		6301	100.00000	1.50000	ACTIVE COMPONENT
33401	FLT DECK FLOOD LTS		6301	100.00000	.90000	ACTIVE COMPONENT
33402	FLT DECK FLOOD LTS		7301	100.00000	.90000	ACTIVE COMPONENT

DUTY CYCLE

TABLE 2-8. POWER VERSUS TIME GRAPH



OUTPUT PROVIDED AT THE END OF THE MISSION

1. Active Components Upon Completion of Mission (Table 2-9) - This output lists those components that are still active at the end of the mission. This provides a check on the timeline sequence used to verify that the Shuttle is in the proper deactivated configuration.

2. Active Component Listing (Table 2-10) - This output lists all components by subsystem and the number of times each component is activated.

3. Subsystem/Mission Phase Analysis (Table 2-11) - This output compares each subsystem power demand to total vehicle power usage during each mission phase. The subsystems are listed with average power, maximum power and percent of total power.

4. Component Usage Listed by Decreasing Percent of Energy Used (Table 2-12) This output provides a power summary for all components, ranking them in decreasing order based on amount of energy consumed during the mission.

5. Subsystem Usage Summary (Table 2-13) - This output lists all electrical components by subsystem with a power summary (power required, use factor, time activated, energy required) of each component.

6. Subsystem Summary by Mission Phase (Table 2-14) - The summary lists each subsystem with its energy demand for all mission phases.

7. Component/Time Input Listing - SEPS provides echo capability of the inputs provided to the program.

2.5 PLOT TAPE

Phase I of the SEPS Program provides a plot tape of time (MET) versus various load parameters defined at 28 volts d-c. Table 2-15 defines the parameters included on the plot tape and their relative word location within each record.

TABLE 2-9. ACTIVE COMPONENTS UPON COMPLETION OF MISSION

COMPONENTS WHICH HAVE NOT BEEN DE-ACTIVATED AT MISSION END

200201	MAIN ENGINE HEATERS		(3)	SWITCH CONDITION	4
200202	MAIN ENGINE HEATERS		(3)	SWITCH CONDITION	4
200203	MAIN ENGINE HEATERS		(3)	SWITCH CONDITION	4
211001	THERMAL CONTROL HTRS		(2)	SWITCH CONDITION	4
211002	THERMAL CONTROL HTRS		(2)	SWITCH CONDITION	4
220701	CAT BED HTRS	5 ON	(16)	SWITCH CONDITION	1
220702	CAT BED HTRS	5 ON	(16)	SWITCH CONDITION	1
220703	CAT BED HTRS	6 ON	(16)	SWITCH CONDITION	1
220801	CAT BED HTRS	8 ON	(24)	SWITCH CONDITION	1
220802	CAT BED HTRS	8 ON	(24)	SWITCH CONDITION	1
220803	CAT BED HTRS	8 ON	(24)	SWITCH CONDITION	1
221101	TANK HTRS AFT		(4)	SWITCH CONDITION	4
221102	TANK HTRS AFT		(4)	SWITCH CONDITION	4
221103	TANK HTRS AFT		(4)	SWITCH CONDITION	4
221104	TANK HTRS AFT		(4)	SWITCH CONDITION	4
501301	AUX MOTOR PUMPS	(1 ON)	(4)	SWITCH CONDITION	1
501302	AUX MOTOR PUMPS	(1 ON)	(4)	SWITCH CONDITION	1
501601	WATER BOILER HTRS		(4)	SWITCH CONDITION	2
501602	WATER BOILER HTRS		(4)	SWITCH CONDITION	4
501603	WATER BOILER HTRS		(4)	SWITCH CONDITION	4
501604	WATER BOILER HTRS		(4)	SWITCH CONDITION	2
600101	AFT AVIONICS HTR		(1)	SWITCH CONDITION	2

TABLE 2-10. COMPONENT ACTIVATION LIST

COMPONENT ACTIVATION LIST

COMPONENT NO.	COMPONENT NAME		NUMBER OF CALLS FROM TIMELINE
10101	IMU	TOTAL ACTIVATION COUNT	2
10102	IMU	TOTAL ACTIVATION COUNT	1
10103	IMU	TOTAL ACTIVATION COUNT	11
10301	STAR TRACKERS	TOTAL ACTIVATION COUNT	1
10302	STAR TRACKERS	TOTAL ACTIVATION COUNT	10
10303	STAR TRACKERS	TOTAL ACTIVATION COUNT	1
10601	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	2
10602	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	2
10603	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	2
10604	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	1
10605	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	1
10606	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	1
10607	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	11
10608	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	11
10609	BODY RATE SENSOR PKG	TOTAL ACTIVATION COUNT	11
10801	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10802	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10803	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10804	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10805	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10806	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10807	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10808	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10809	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10810	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10811	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10812	ACCEL PKG-NORMAL LATERAL	TOTAL ACTIVATION COUNT	1
10901	ANGLE OF ATTACK PROBE	TOTAL ACTIVATION COUNT	1
10902	ANGLE OF ATTACK PROBE	TOTAL ACTIVATION COUNT	1
10903	ANGLE OF ATTACK PROBE	TOTAL ACTIVATION COUNT	1
11001	OMS TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	1
11002	OMS TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	10
11003	OMS TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	1
11101	APS DRIVER/MONITOR	TOTAL ACTIVATION COUNT	1
11102	APS DRIVER/MONITOR	TOTAL ACTIVATION COUNT	0 NEVER ACTIVATED
11103	APS DRIVER/MONITOR	TOTAL ACTIVATION COUNT	11
11104	APS DRIVER/MONITOR	TOTAL ACTIVATION COUNT	11
11301	TVC MONITOR	TOTAL ACTIVATION COUNT	12
11302	TVC MONITOR	TOTAL ACTIVATION COUNT	21
11401	MPS TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	1
11402	MPS TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	1
11403	MPS TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	1
11501	SRB TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	1
11502	SRB TVC DRIVER UNIT	TOTAL ACTIVATION COUNT	1
11601	AERO SURFS DRIVER UNIT	TOTAL ACTIVATION COUNT	2
11602	AERO SURFS DRIVER UNIT	TOTAL ACTIVATION COUNT	2
11603	AERO SURFS DRIVER UNIT	TOTAL ACTIVATION COUNT	2
11604	AERO SURFS DRIVER UNIT	TOTAL ACTIVATION COUNT	2
11801	BKUP OPTICAL UNIT	TOTAL ACTIVATION COUNT	0 NEVER ACTIVATED
12001	PITOT STATIC PROBE	TOTAL ACTIVATION COUNT	1

TABLE 2-11. SUBSYSTEM/MISSION PHASE ANALYSIS

MISSION PHASE = 5
RENDEZVOUS+DOCKING
FROM 19.2086 HOURS MET TO 25.0000 HOURS MET

SYSTEM	SYSTEM DESCRIPTION	AVERAGE KW	PERCENT	MAXIMUM KW	TIME OF MAXIMUM
1	GUIDANCE, NAVIGATION, AND CONTROL	.89185	9.7653350	.89580	24.43333
2	COMMUNICATIONS	.42344	4.6364501	1.00700	24.30450
3	DISPLAY AND CONTROLS	1.50624	16.4927390	1.69338	24.43333
4	OPERATIONAL FLIGHT INSTRUMENTATION	.34000	3.7228547	.34000	25.00000
6	ELECTRICAL POWER DIST AND CONTROL	.42313	4.6002810	.98550	24.43333
7	DATA PROCESSING	2.43200	26.6293416	2.43200	24.43333
8	PAYLOAD MANAGEMENT	.00685	.0749762	.04000	25.00000
21	ORBIT MANEUVERING SYSTEM	.79492	8.7040212	.79492	24.43333
22	REACTION CONTROL SYSTEM	.18572	2.0335968	.37024	23.97833
30	POWER GENERATION SYSTEM	.38022	4.1632022	.38022	25.00000
31	POWER REACT STOR AND DIST	.04160	.4555021	.04160	25.00000
40	ENVIRONMENTAL CONTROL AND LIFE SUP	1.70981	18.7217016	2.60880	25.00000

TOTAL KWH REQUIRED FOR MISSION PHASE 5			52.89154 KWH
TOTAL KWH ACCUMULATED TO MISSION TIME		25.00000	196.15139 KWH
AVERAGE POWER	9.13277 KW		
PEAK POWER	10.54945 KW		
TIME OF PEAK POWER	23.97833 HOURS		

TABLE 2-12. COMPONENT USAGE LISTED BY DECREASING PERCENT OF ENERGY USED

COMPONENT USAGE LISTED BY DECREASING PERCENT OF POWER USED

	COMPONENT NUMBER	COMPONENT DESCRIPTION	COMPONENT POWER (WATTS)	REF LOAD NO	AVERAGE USE FACTOR (PERCENT)	TOTAL ON TIME (HOURS)	COMP ENERGY REQUIRED (WATT HOURS)	PERCENT OF TOTAL MISSION ENERGY REQUIRED	ACCUMULATED PERCENT
1	501302	AUX MOTOR PUMPS (1 ON)	970.00	15	99.9999	89.5455	.86859080*05	5.2375076	5.2375076
2	501301	AUX MOTOR PUMPS (1 ON)	970.00	11	99.9999	89.5455	.86859080*05	5.2375076	10.4750152
3	401401	CABIN HEATER	1000.00	1	99.9999	82.0848	.82086726*05	4.9497399	15.4247550
4	400101	CABIN FANS	319.00	52	149.9998	167.9167	.80348005*05	4.8448949	20.2696519
5	70102	BASIC COMPUTER (48K)	400.00	27	99.9999	167.9167	.67166575*05	4.0500711	24.3197229
6	70101	BASIC COMPUTER (48K)	400.00	25	99.9999	167.9167	.67166575*05	4.0500711	28.3697939
7	400401	FREON PUMPS	202.00	52	149.9997	167.9167	.50878664*05	3.0679279	31.4377217
8	401001	FOOD MGMT	1500.00	30	100.0000	30.5668	.45850156*05	2.7647143	34.2024360
9	21304	S-BAND XCVR (TDRS) UNIT 2	220.00	28	99.9999	165.7981	.36475523*05	2.1994342	36.4018698
10	10102	IMU	185.00	6	99.9999	167.9167	.31064540*05	1.8731578	38.2750273
11	10101	IMU	185.00	4	99.9999	167.9167	.31064540*05	1.8731578	40.1481848
12	300503	FCP PUMPS	180.00	18	99.9999	167.9167	.30224961*05	1.8225321	41.9707165
13	300501	FCP PUMPS	180.00	10	99.9999	167.9167	.30224961*05	1.8225321	43.7932482
14	311702	HTRS O2	500.00	2	30.0000	167.9167	.25187463*05	1.5187745	45.3120246
15	311701	HTRS O2	500.00	1	30.0000	167.9167	.25187463*05	1.5187745	46.8308010
16	401003	FOOD MGMT	100.00	52	149.9998	167.1080	.25066154*05	1.5114618	48.3422627
17	70202	GN*C I/O UNITS	125.00	27	99.9999	167.9167	.20989554*05	1.2656472	49.6079097
18	70201	GN*C I/O UNITS	125.00	25	99.9999	167.9167	.20989554*05	1.2656472	50.8735566
19	32102	DISPLAY PROCESSORS	120.00	27	99.9999	167.9167	.20149978*05	1.2150217	52.0885782
20	32101	DISPLAY PROCESSORS	120.00	25	99.9999	167.9167	.20149978*05	1.2150217	53.3035998
21	401302	AVIONICS BAY FANS AFT	80.00	53	149.9998	167.9167	.20149970*05	1.2150212	54.5186210
22	401301	AVIONICS BAY FANS AFT	80.00	52	149.9998	167.9167	.20149970*05	1.2150212	55.7336421
23	401203	AVIONICS BAY FANS FWD	64.70	54	149.9998	167.9167	.16296287*05	.9826483	56.7162900
24	401202	AVIONICS BAY FANS FWD	64.70	53	149.9998	167.9167	.16296287*05	.9826483	57.6989379
25	401201	AVIONICS BAY FANS FWD	64.70	52	149.9998	167.9167	.16296287*05	.9826483	58.6815858
26	401104	WASTE*POT WATER	460.00	28	79.5316	39.5923	.14484669*05	.8734097	59.5549951
27	401103	WASTE*POT WATER	460.00	26	79.5316	39.5923	.14484669*05	.8734097	60.4284043
28	400301	WATER PUMPS	53.00	54	149.9998	167.9167	.13349358*05	.8049517	61.2333560
29	60503	LOAD CONTR ASSY-AFT	75.00	3	99.9999	167.9167	.12593732*05	.7593883	61.9927440
30	60502	LOAD CONTR ASSY-AFT	75.00	2	99.9999	167.9167	.12593732*05	.7593883	62.7521319
31	60501	LOAD CONTR ASSY-AFT	75.00	1	99.9999	167.9167	.12593732*05	.7593883	63.5115199
32	60403	LOAD CONTR ASSY-FWD	75.00	30	99.9999	167.9167	.12593732*05	.7593883	64.2709079
33	60402	LOAD CONTR ASSY-FWD	75.00	28	99.9999	167.9167	.12593732*05	.7593883	65.0302959
34	60401	LOAD CONTR ASSY-FWD	75.00	26	99.9999	167.9167	.12593732*05	.7593883	65.7896838
35	40302	PCM MASTER UNIT	60.00	28	99.9999	167.9167	.10074989*05	.6075108	66.3971939
36	31902	CRT DISPLAY UNITS	60.00	7	99.9999	167.9167	.10074989*05	.6075108	67.0047045
37	31901	CRT DISPLAY UNITS	60.00	6	99.9999	167.9167	.10074989*05	.6075108	67.6122150
38	42801	AFT AVIONICS HTR	400.00	1	100.0000	23.2011	.92804200*04	.5595992	68.1718140
39	210902	THERMAL CONTROL HTRS	400.00	3	100.0000	23.0907	.92362902*04	.5569382	68.7287521
40	210901	THERMAL CONTROL HTRS	400.00	2	100.0000	23.0907	.92362902*04	.5569382	69.2856903
41	401501	INSTRUMENTATION	50.00	1	99.9999	167.9167	.83958219*04	.5062589	69.7919493
42	70402	AUX MEMORY (16K)	50.00	27	99.9999	167.9167	.83958219*04	.5062589	70.2982083
43	70401	AUX MEMORY (16K)	50.00	25	99.9999	167.9167	.83958219*04	.5062589	70.8044673
44	200203	MAIN ENGINE HEATERS	300.00	3	100.0000	23.0907	.69272177*04	.4177037	71.2221680
45	200202	MAIN ENGINE HEATERS	300.00	2	100.0000	23.0907	.69272177*04	.4177037	71.6398716

TABLE 2-13. SUBSYSTEM USAGE SUMMARY

COMPONENT USAGE LISTED BY SUBSYSTEM

ENVIRONMENTAL CONTROL AND LIFE SUP

	COMPONENT NUMBER	COMPONENT DESCRIPTION	COMPONENT DC LOAD (WATTS)	REF LOAD NO	AVERAGE USE FACTOR (PERCENT)	TOTAL ON TIME (HOURS)	COMP ENERGY REQUIRED (WATT HOURS)	PERCENT OF TOTAL MISSION ENERGY REQUIRED
1	400101	CABIN FANS	430.65	52	99.9999	167.9167	.72313217+05	19.6548090
2	400102	CABIN FANS	430.65	53	.0000	.0000	.00000000	.0000000
3	400103	CABIN FANS	430.65	54	.0000	.0000	.00000000	.0000000
4	400201	CABIN PRESS+N2 STOR	14.31	52	99.9998	167.9167	.24028838+04	.6531064
5	400202	CABIN PRESS+N2 STOR	14.31	53	.0000	.0000	.00000000	.0000000
6	400203	CABIN PRESS+N2 STOR	14.31	54	.0000	.0000	.00000000	.0000000
7	400301	WATER PUMPS	71.55	54	99.9999	167.9167	.12014420+05	3.2655320
8	400302	WATER PUMPS	71.55	52	.0000	.0000	.00000000	.0000000
9	400303	WATER PUMPS	71.55	53	.0000	.0000	.00000000	.0000000
10	400401	FREON PUMPS	272.70	52	99.9999	167.9167	.45795809+05	12.4459904
11	400402	FREON PUMPS	272.70	53	.0000	.0000	.00000000	.0000000
12	400403	FREON PUMPS	272.70	54	.0000	.0000	.00000000	.0000000
13	400501	H2O SUBLIMATOR SYSTEM	27.00	52	99.9999	165.1069	.44578810+04	1.2116568
14	400502	H2O SUBLIMATOR SYSTEM	27.00	53	.0000	.0000	.00000000	.0000000
15	400503	H2O SUBLIMATOR SYSTEM	27.00	54	.0000	.0000	.00000000	.0000000
16	400504	H2O SUBLIMATOR SYSTEM	20.00	1	.0000	.0000	.00000000	.0000000
17	400505	H2O SUBLIMATOR SYSTEM	20.00	2	.0000	.0000	.00000000	.0000000
18	400506	H2O SUBLIMATOR SYSTEM	20.00	3	.0000	.0000	.00000000	.0000000
19	400601	SPACE RAD CONTR+VLVS	20.00	1	99.9999	165.1069	.33021349+04	.8975238
20	400602	SPACE RAD CONTR+VLVS	20.00	2	.0000	.0000	.00000000	.0000000
21	400603	SPACE RAD CONTR+VLVS	20.00	3	.0000	.0000	.00000000	.0000000
22	400701	AMMONIA CONTR BOX/VLV	25.00	1	50.0000	1.8264	.22829866+02	.0062052
23	400702	AMMONIA CONTR BOX/VLV	25.00	2	.0000	.0000	.00000000	.0000000
24	400901	WASTE MGMT	189.00	52	67.2567	32.8675	.41779601+04	1.1355740
25	400902	WASTE MGMT	189.00	53	67.2567	32.8675	.41779601+04	1.1355740
26	400903	WASTE MGMT	189.00	54	67.2567	32.8675	.41779601+04	1.1355740
27	400904	WASTE MGMT	10.00	1	67.2568	32.8675	.22105612+03	.0600833
28	400905	WASTE MGMT	10.00	2	67.2568	32.8675	.22105612+03	.0600833
29	400906	WASTE MGMT	10.00	3	67.2568	32.8675	.22105612+03	.0600833
30	401001	FOOD MGMT	1500.00	30	100.0000	30.5668	.45850156+05	12.4621209
31	401002	FOOD MGMT	1500.00	26	.0000	.0000	.00000000	.0000000
32	401003	FOOD MGMT	135.00	52	100.0000	30.5668	.41265141+04	1.1215909
33	401004	FOOD MGMT	135.00	53	.0000	.0000	.00000000	.0000000
34	401101	WASTE+POT WATER	16.20	52	79.5316	39.5923	.51011224+03	.1386490
35	401102	WASTE+POT WATER	16.20	53	79.5316	39.5923	.51011224+03	.1386490
36	401103	WASTE+POT WATER	460.00	26	79.5316	39.5923	.14484669+05	3.9369485
37	401104	WASTE+POT WATER	460.00	28	79.5316	39.5923	.14484669+05	3.9369485
38	401201	AVIONICS BAY FANS FWD	87.34	52	99.9999	167.9167	.14666664+05	3.9864149
39	401202	AVIONICS BAY FANS FWD	87.34	53	99.9999	167.9167	.14666664+05	3.9864149
40	401203	AVIONICS BAY FANS FWD	87.34	54	99.9999	167.9167	.14666664+05	3.9864149
41	401301	AVIONICS BAY FANS AFT	108.00	52	.0000	.0000	.00000000	.0000000
42	401302	AVIONICS BAY FANS AFT	108.00	53	.0000	.0000	.00000000	.0000000
43	401401	CABIN HEATER	1000.00	1	99.9999	82.0530	.82052901+05	22.3020654
44	401501	INSTRUMENTATION	50.00	1	99.9999	167.9167	.83958220+04	2.2819933

TOTAL ENERGY CONSUMED BY ALL COMPONENTS .36791615+06 WATT HOURS

TOTAL MISSION TIME .16791667+03 HOURS

TABLE 2-14. SUBSYSTEM SUMMARY BY MISSION PHASE

SUBSYSTEM USAGE SUMMARY BY MISSION PHASE
MISSION PHASE 1 THRU 10

SYSTEM	SYSTEM DESCIPTION	1 KWH	2 KWH	3 KWH	4 KWH	5 KWH	6 KWH	7 KWH	8 KWH	9 KWH	10 KWH
1	GUIDANCE, NAVIGATION, AND CONTROL	751.55	484.63	500.07	636.69	474.96	535.06	599.17	473.20	473.20	511.30
2	COMMUNICATIONS	643.56	459.60	459.60	459.60	459.60	496.72	1331.44	923.33	459.60	459.60
3	DISPLAY AND CONTROLS	1226.05	648.56	707.21	903.69	664.23	751.07	1147.73	817.71	656.89	719.26
4	OPERATIONAL FLIGHT INSTRUMENTATION	573.58	523.12	523.12	523.12	523.12	523.12	523.12	523.12	523.12	523.12
5	DEVELOPMENTAL FLIGHT INSTRUMENTATION	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	ELECTRICAL POWER DIST AND CONTROL	634.59	750.00	750.00	750.00	750.00	783.21	1530.00	1164.88	750.00	750.00
7	DATA PROCESSING	2565.06	1460.00	1519.63	1822.84	1460.33	1597.29	1739.56	1460.00	1460.00	1544.56
8	PAYLOAD MANAGEMENT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9	UNMANNED KIT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	EXTERNAL TANK (ET)	34.24	280.00	70.77	.00	.00	.00	.00	.00	.00	.00
16	SOLID ROCKET BOOSTER (SRB)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	MAIN PROPULSION SYSTEM	332.41	.00	.00	.00	.00	.00	.00	.00	.00	.00
21	ORBIT MANEUVERING SYSTEM	52.52	206.86	89.20	542.76	12.46	205.36	418.19	.00	.00	134.50
22	REACTION CONTROL SYSTEM	53.51	493.04	332.07	125.04	269.40	366.08	313.93	352.42	325.26	341.52
23	AIR BREATHING ENGINE SYSTEM	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
30	POWER GENERATION SYSTEM	2101.82	380.22	380.22	380.22	380.22	380.22	380.22	380.22	380.22	380.22
31	POWER REACT STOR AND DIST	351.88	417.00	417.00	417.00	417.00	417.00	417.00	417.00	417.00	417.00
32	AUX POWER UNIT	602.08	400.00	337.56	.00	.00	.00	.00	.00	.00	.00
40	ENVIRONMENTAL CONTROL AND LIFE SUP	1689.57	4008.05	4102.28	4207.28	2647.22	2184.29	2161.59	2126.15	2616.17	2652.94
50	HYDRAULICS POWER SYSTEM	27.67	.00	.00	.00	.00	.00	.00	.00	1072.04	1382.66
51	DOCKING AND CARGO HNDLG	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
52	MECHANICAL SYSTEM AND LDG	119.53	2540.00	641.95	.00	.00	.00	.00	.00	.00	.00

TABLE 2-15. SEPS PHASE 1 PLOT TAPE

WORD LOCATION	PURPOSE
1	Time
2	Total dc load
3	Total fuel cell load includes losses
4	Fuel cell 1 load
5	Fuel cell 2 load
6	Fuel cell 3 load
7-106	Subsystem load

2.6 PHASE I INTERFACE TAPE

Phase I of the SEPS Program provides as an output an interface tape which contains event time point data including time, loads, power factors, and circuit switch positions to drive Phase II through a defined mission timeline. Associated with this interface tape, a compacted component dictionary built in Phase I is required and it can be stored on the interface tape or on another tape The storage location of the compacted dictionary and the interface tape is controlled by user and is defined to the program through the "units" card. Explanation of card usage is in Section 4.

3.0 SEPS PHASE II

3.0 SEPS PHASE II

3.1 DISCUSSION

The SEPS Phase II program integrates a collection of math models that define the operating characteristics of the power sources, distribution, and equipment of the input electrical power system. This provides the capability of simulating the total electrical power system with which system design and design/mission requirements compatiblity can be analyzed and parametric studies performed by making variable data and timeline changes. The program, using an input circuit definition of the electrical power system, solves the electrical circuit at each defined time point to a defined load configuration. The derived information is then provided as output data.

The Phase II outputs available to the user are:

1. FORMATTED PRINTOUT - dc DISTRIBUTION NETWORK, SOURCE, AND INVERTER STATUS printout occurs whenever Phase II is run.
2. CRYOGEN USAGE - printout occurs whenever Phase II is run.
3. INTERFACE TAPE - Similar to Phase I interface tape and is available at user option.
4. COMUSE - Requires interface tape and is available at user option.
5. CONSTRAINT VIOLATIONS - User Option

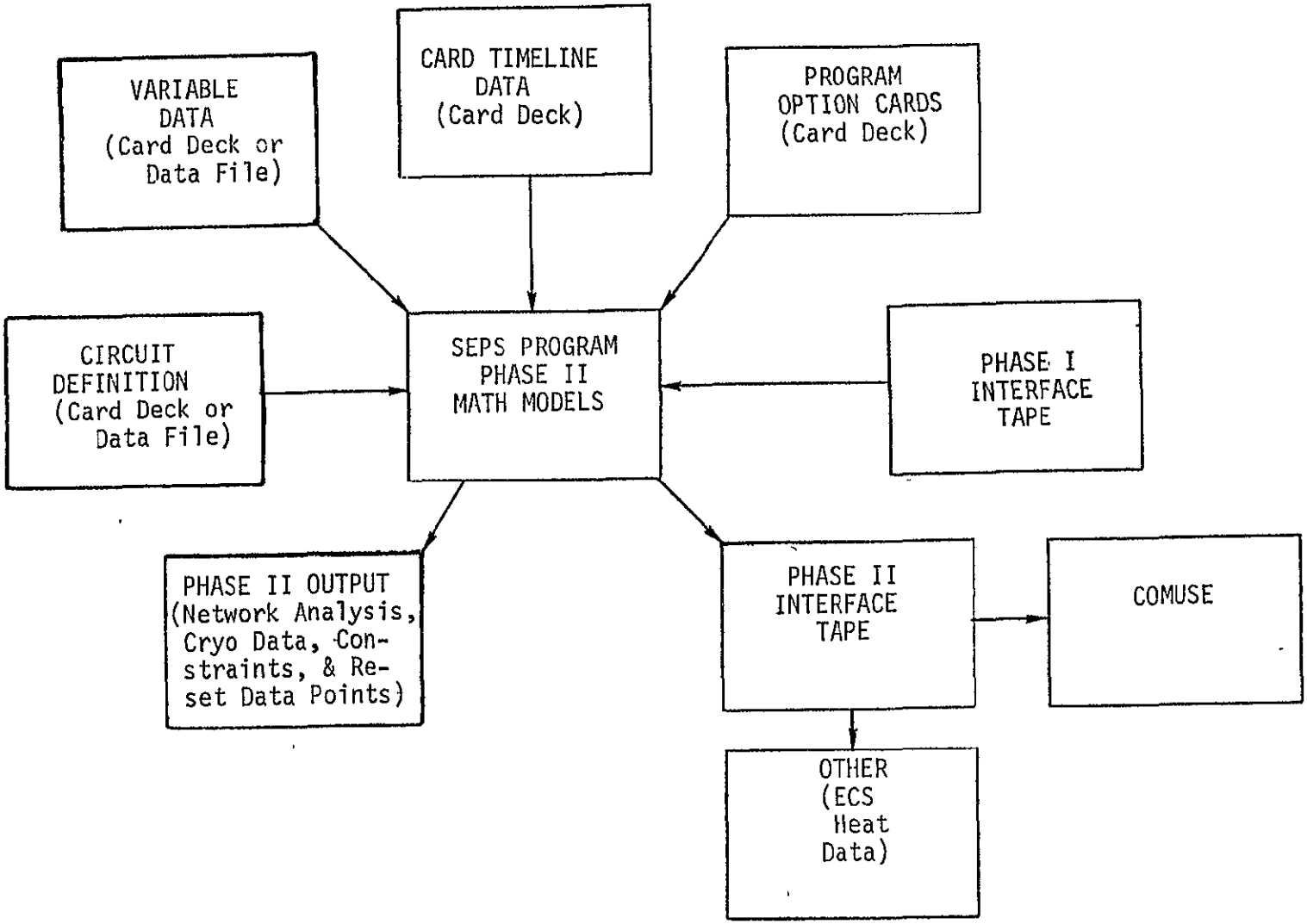
The inputs for Phase II operation can be grouped in the following categories:

1. CIRCUIT DEFINITION DATA
2. VARIABLE DATA
3. CARD TIMELINE DATA
4. PROGRAM OPTION CARD DATA
5. INTERFACE TAPE DATA

Each input is described in detail in Section 3.2. See Figure 3-1 for Input/Output Flow Diagram.

FIGURE 3-1

INPUT/OUTPUT FLOW DIAGRAM OF SEPS PHASE II



Phase II can be operated in three different modes dependent upon what type of timeline is used. The three modes are:

1. Card deck timeline mode - Would be used to perform simple parametric studies of the electrical power system. A sample listing of input deck is shown in Appendix D.

2. Interface tape timeline mode - Would be used to perform mission analysis. A sample listing of input deck is shown in Appendix E.

3. Interface tape with timeline adjustments mode - Would be used to perform system contingency operation analysis and equipment design/ mission requirements capability. A sample listing of input deck is shown in Appendix F.

3.2 PHASE II INPUT DATA

3.2.1 Circuit Definition

A description of the dc distribution circuit and a definition of an associated inverter system is provided as input to Phase II. The dc distribution circuit is defined in terms of branches and the elements contained in each branch (such as sources, loads, diodes, etc.). The inverter system is defined in relation to the dc circuit and in terms of the number of inverters, the number of associated dc loads, the number of ac buses, which inverter is connected to which ac bus and where the input inverter dc load is to be applied within the dc circuit.

3.2.1.1 Circuit Elements

The elements that are used to make up the circuit description are categorized by sources and loads. A maximum of twelve sources in a circuit description can be handled by Phase II. The type sources that can be used in the circuit description are:

1. Fuel Cell - maximum of 5

2. Battery - maximum of 6 (2 types of I-V curves allowed)

3. Other - maximum of 12, these are simulated by an input I-V curve for each source (such as a transformer rectifier). Maximum of 2 input I-V curves for "other" sources (Type 3 or Type 4).

The types of load components that can be used in simulating the electrical circuit are:

1. dc equipment loads - includes constant power, constant resistance and three point load data.

2. ac inverter and ac equipment loads - in the circuit analysis, these loads are converted to the amount of dc power required for ac operation including efficiency losses (cannot be combined with other loads in the same branch).

3. Remote Power Controller (RPC) - includes a voltage drop, forward resistance, reverse resistance and no-load resistance.

4. Diode - includes a voltage drop, forward resistance and reverse resistance.

5. Battery charger - Load required to recharge battery, value changes to zero charge load when SOC reaches 100%. (cannot be combined with other loads in the same branch)

6. Line loss - line resistance between two nodes.

A total of fifty DC LOADS can be used in developing the input circuit description. A LOAD can be any combination of the components listed above with the exception of the two (2 and 5) so stated above.

3.2.1.2 Distribution Circuit Description

The distribution circuit is defined in terms of branches and nodes. This information is provided as an input to the computer program. For Phase II, a branch is defined as an electrical circuit path that contains an element (source, loads, line resistance, etc.,) and a switch. A node is a junction point of two or more branches.

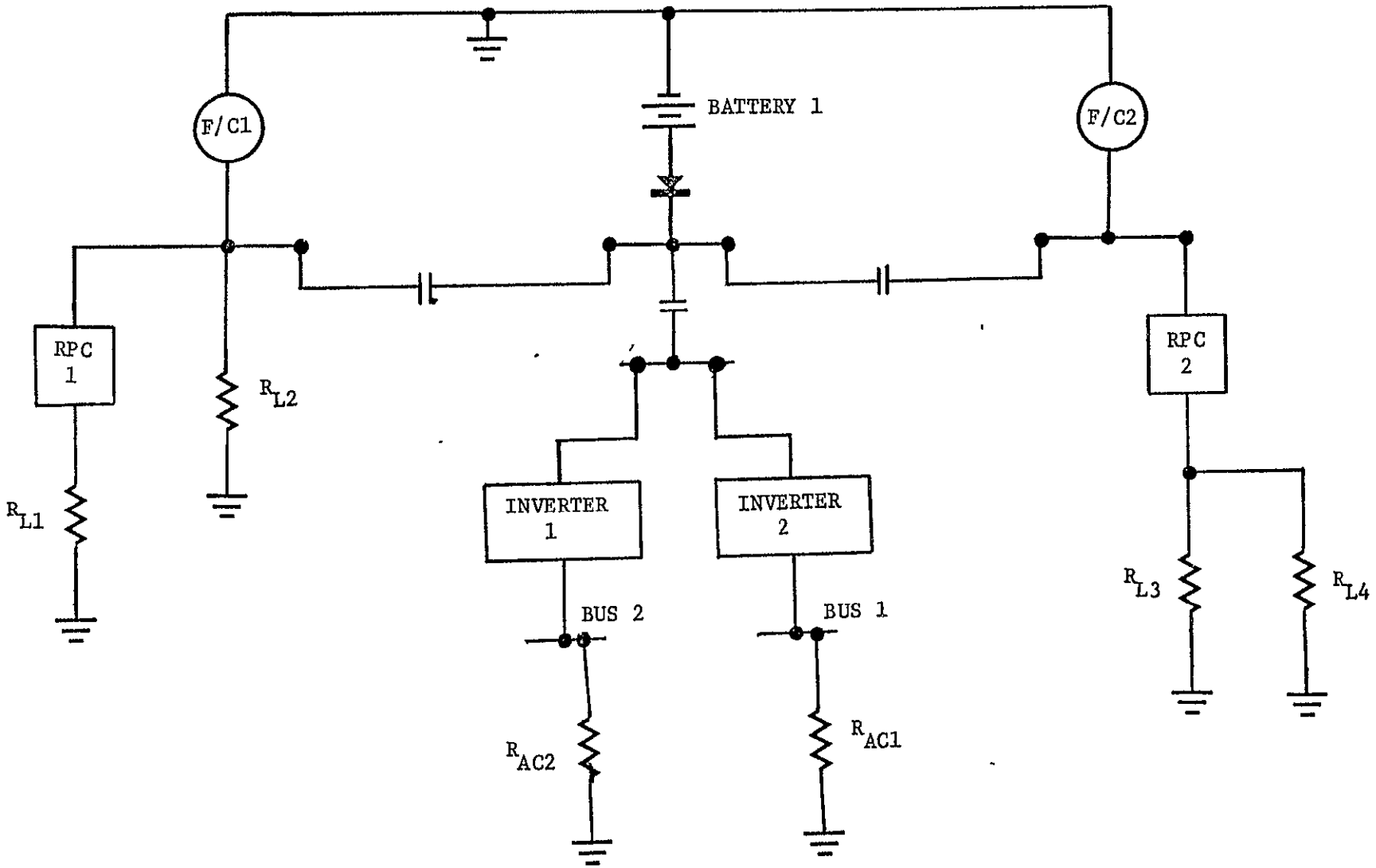
3.2.1.3 Simple Circuit

Figure 3-2 is a typical circuit that contains most of the elements available for program circuit analysis. Some general rules that must be followed in describing the circuit in branches and nodes are:

1. Loads used for the charger and those used for inverter dc loads cannot be used for any other loads.

2. Branch switches and lead resistances will have the same number as the branch in which they are located.

FIGURE 3-2. SIMPLE CIRCUIT



3. Each branch will contain a switch and a lead resistance and the value of the resistance must be greater than .0005 ohms except when the branch contains a load.

4. A load cannot be included in a branch that contains a source.

5. All real (R) data values must have a decimal point.

6. Maximum of 30 nodes (including ground or reference node)

7. Maximum of 9 inverters

8. Maximum of 100 branches

9. Maximum of 12 sources

10. Maximum of 50 loads

11. Maximum of 100 diodes including RPC's

12. The Branches which contain a source, the current flow must be defined from the lower voltage to the higher voltage node.

13. Branches which contain a diode or a RPC, the current flow definition must be in the positive direction of diode or RPC flow.

14. Data on each card should start in column 2.

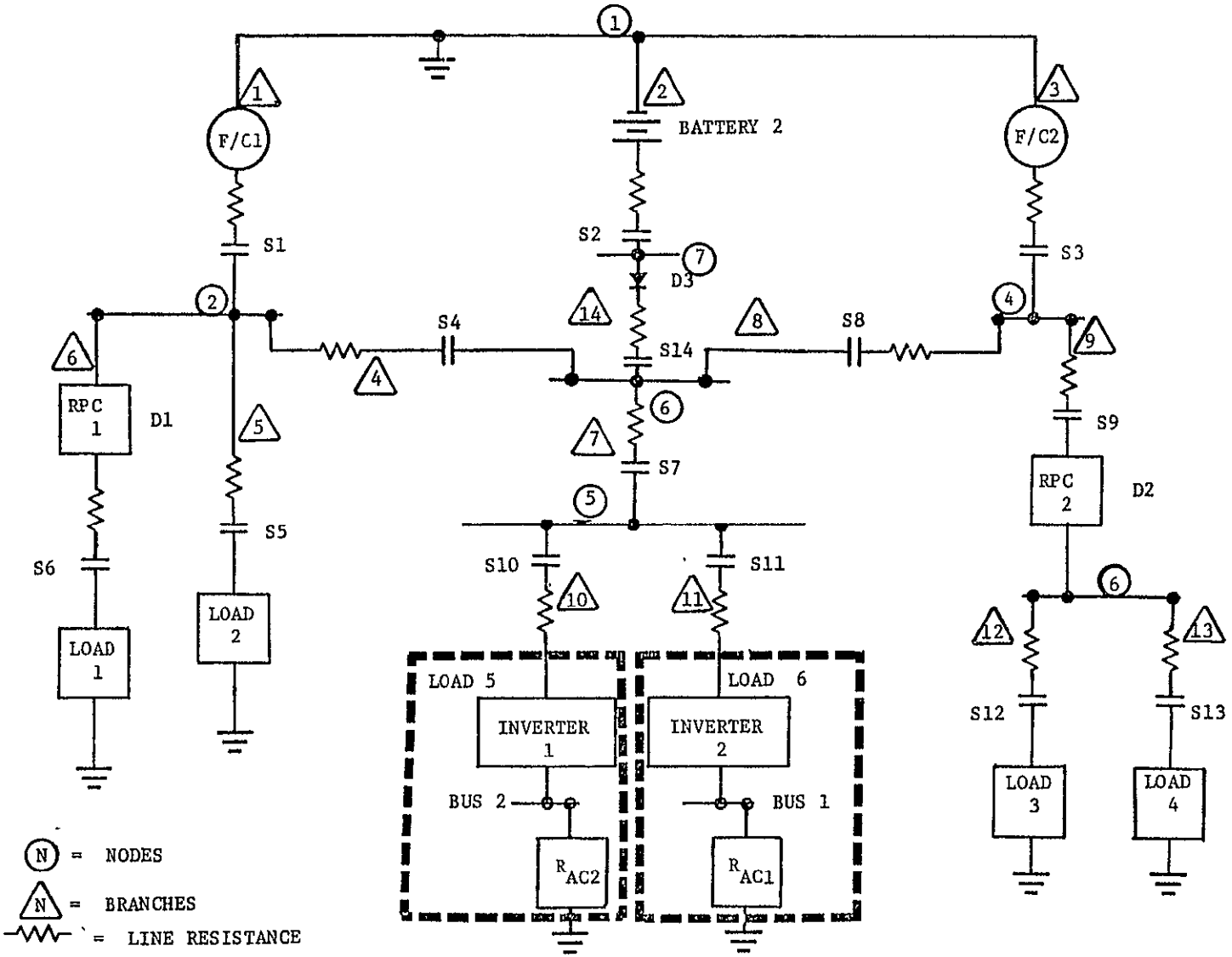
15. Sources are to be numbered consecutively with a maximum number of 12.

Figure 3-3 shows the typical circuit with the circuit defined in terms of branches, nodes and elements required for coding into the SEPS program.

3.2.1.4 Circuit Input Data

The data describing the circuit is read from a card image tape file or from a card deck input to the data tape through program WLCCIT in forming a new file on the data tape. To develop the tape file, the format used to input the circuit description is a Free Field Format, i.e., each value is to be separated by a comma, all data must be listed in proper sequence on each card, and all data must be present even if the value is zero or blank. The end of each card is used as a comma. Figure 3-4 shows the required card deck set up and Figure 3-5 states what data information is to be included on each card. Figure 3-6 is a listing of the card deck used to describe the simple circuit in Figure 3-3.

FIGURE 3-3. BRANCH/NODE/ELEMENT CONFIGURATION OF SIMPLE CIRCUIT



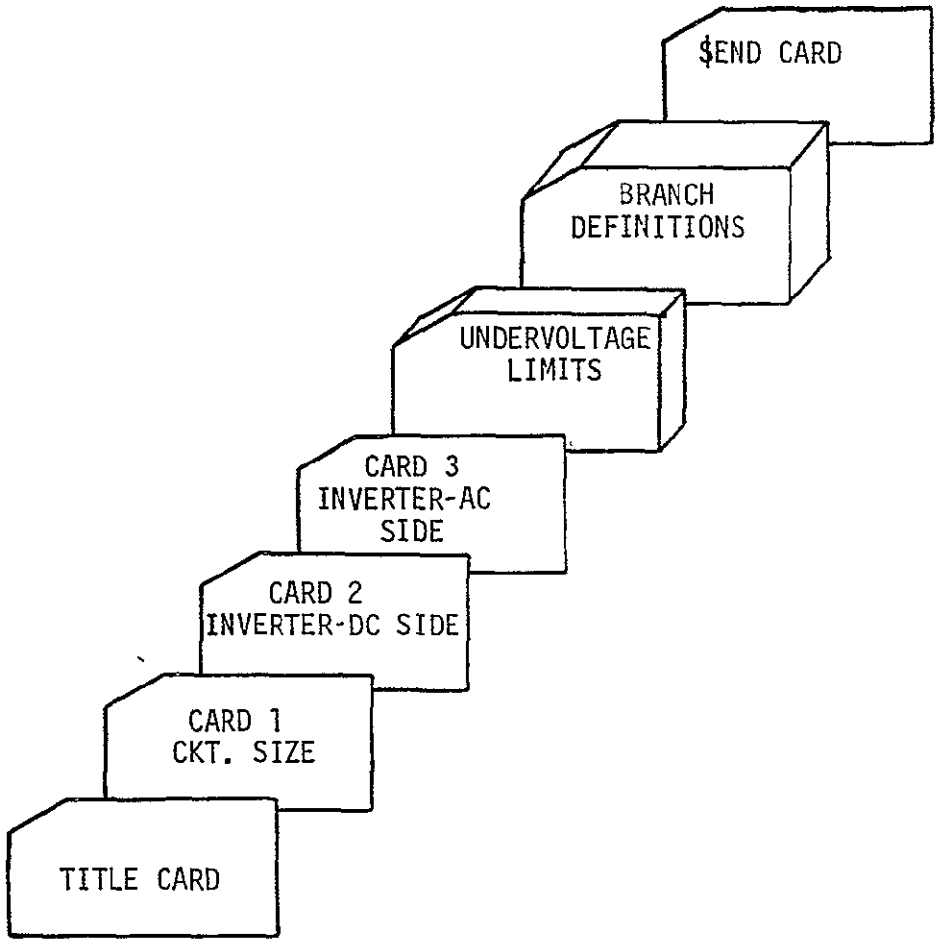


FIGURE 3-4. - CIRCUIT DEFINITION DECK SETUP

FIGURE 3-5.

CARD DATA (FREE FIELD FORMAT)*

CARD	VARIABLE TYPE		CARD INFORMATION
TITLE CARD			NAME GIVEN TO CIRCUIT
CARD 1	I	1.	No. of Nodes (including ground or reference node) (maximum of 30)
	I	2.	No. of Reference Nodé
	I	3.	No. of Inverters (maximum of 9)
	I	4.	No. of the Load reserved for the battery charger. If battery charger not used, insert zero as load number.
CARD 2	I	1.	Quantity of D-C Loads used for Inverter Loads (minimum of 1)
	I	2.	Branch Nos. containing the d-c Loads (each branch number seperated by a comma)
	I	3.	Inverter numbers associated with the above dc LOAD (listed in corresponding sequence as branches)
CARD 3	I	1.	Quantity of A-C Load Buses supplied by inverters (minimum of 1)
	I	2.	Inverter No. (relative no.) connected to AC Bus 1
	I	3.	Inverter No. (relative no.) connected to AC Bus 2
	I	4.	Inverter No. (relative no.) connected to AC Bus 3
UNDERVOLTAGE LIMITS	R.	1.	One under voltage limit for each node (number of nodes taken from card 1). If no under voltage limit applies, use -10. for the limit. Separate each value by a comma. Use as many cards as necessary.
BRANCH DEFINITIONS (one card per branch, each card containing the information described at the right.)	I	1.	Branch number (maximum and largest allowable is 100)
	I	2.	Node number from which current flows
	I	3.	Node number into which current flows
	I	4.	Source number (maximum and largest allowable is 12)
	I	5.	Source type (Type 1 = Fuel cell, Type 2 = Battery, Type 3 = OTHER 1, Type 4 = OTHER 2)
	I	6.	Relative source number (relative to type, such as fuel cell 1, 2 and 3) (maximum of 5 fuel cells and up to 6 batteries)

FIGURE 3-5. (CONTINUED)

CARD DATA (FREE FIELD FORMAT)*

CARD	VARIABLE TYPE		CARD INFORMATION
BRANCH DEFINITIONS (CONTINUED)	I	7.	Load number (maximum and largest allowable is 50)
	I	8.	Relative diode number (maximum and largest allowable 100)
	R	9.	Lead resistance of branch (minimum value of .0005)
	R	10.	Diode or RPC voltage drop
	R	11.	Diode or RPC forward resistance
	R	12.	Diode or RPC back resistance
	R	13.	RPC no load resistance value at 28 volts which is to be used to calculate RPC no load power loss
	R	14.	Branch current limit
	I	15.	Switch position of branch switch (initial condition) (closed = 1, open = 0)
END CARD		1.	This card is used to end the circuit definition. Place a - 10 followed by 14 commas on the card.

*Start each card in column 2

FIGURE 3-6.- INPUT CARD LISTING - EXAMPLE-

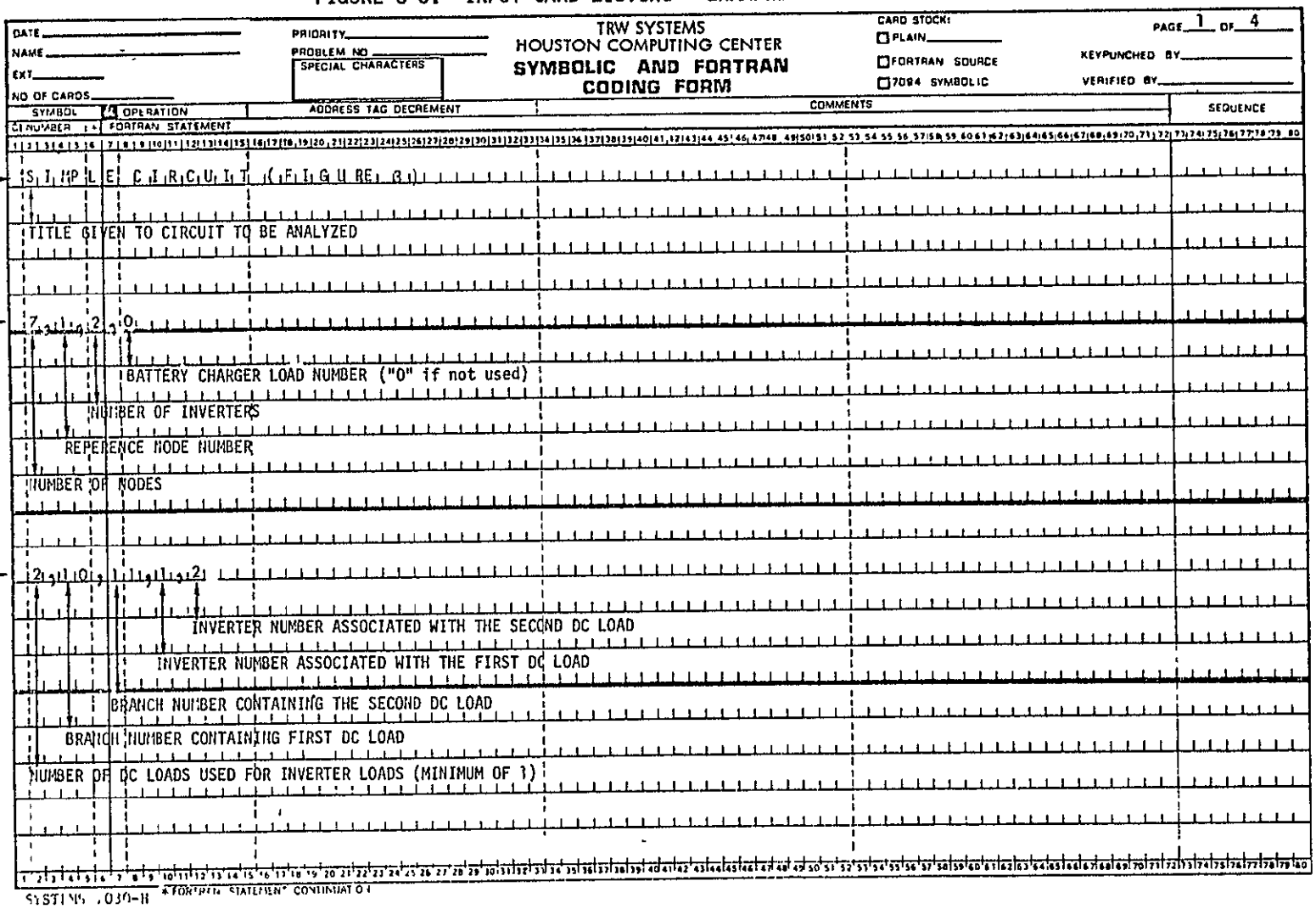


FIGURE 3-6. INPUT CARD LISTING - EXAMPLE (CONTINUED)

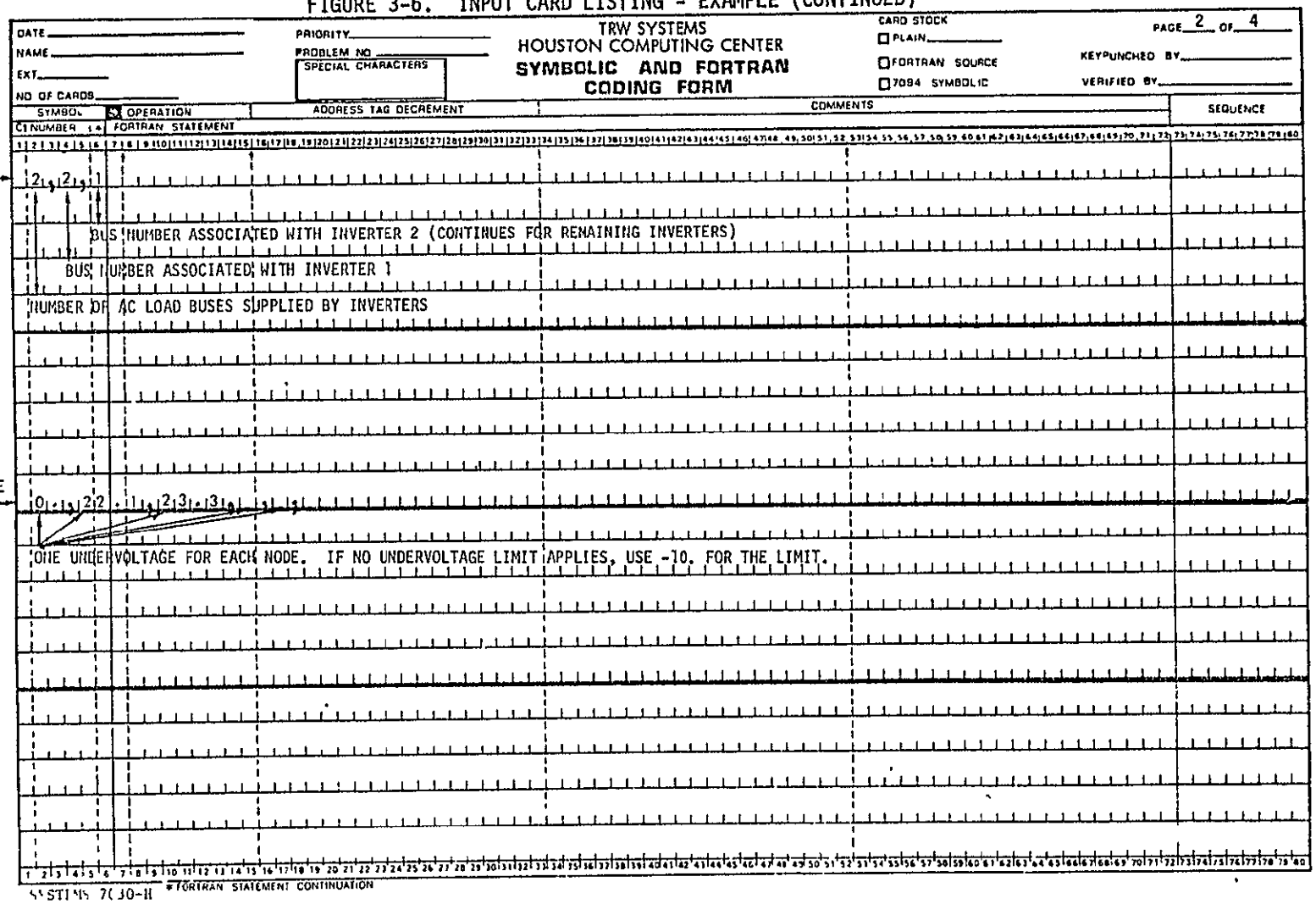


FIGURE 3-6. INPUT CARD LISTING - EXAMPLE (CONTINUED)

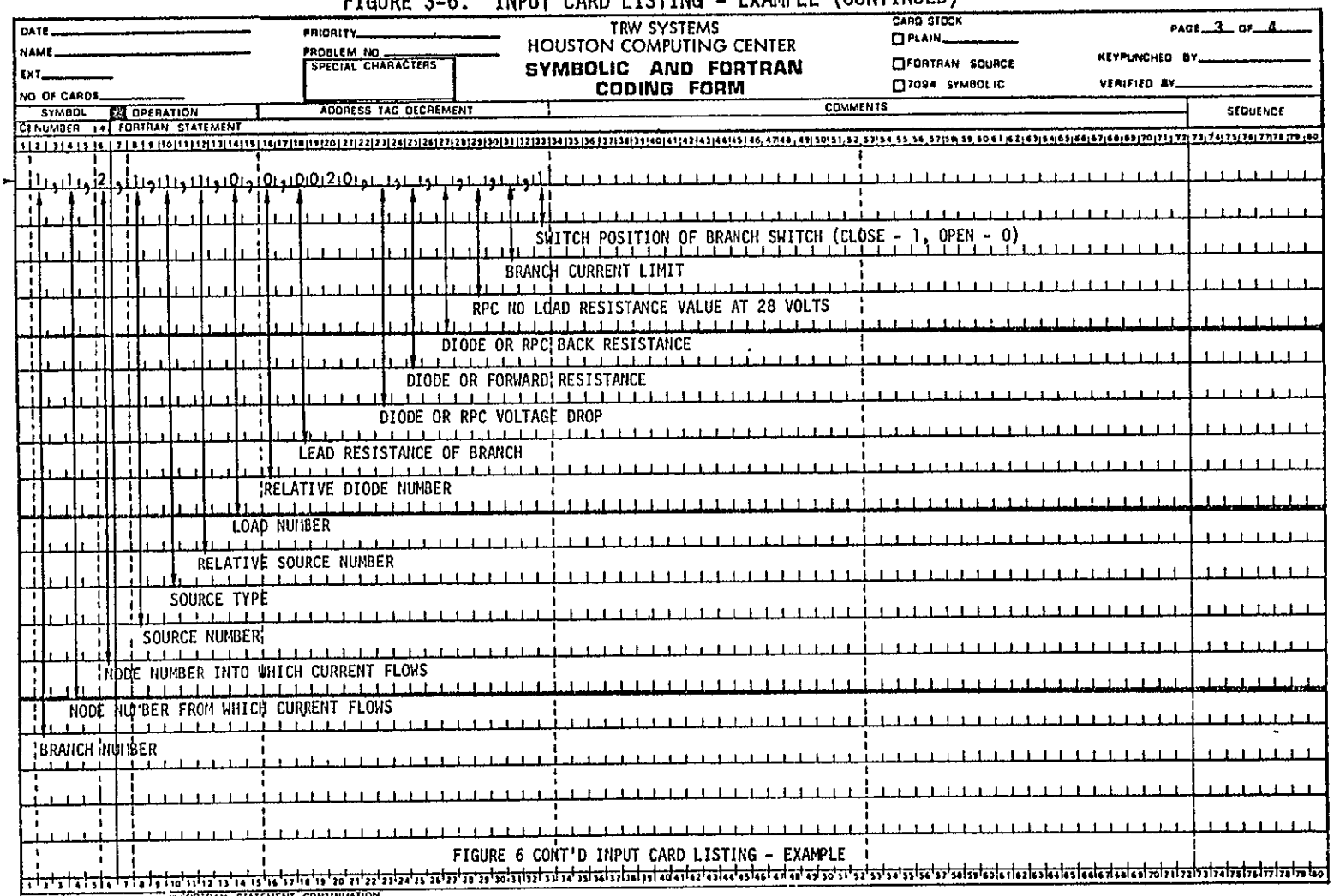
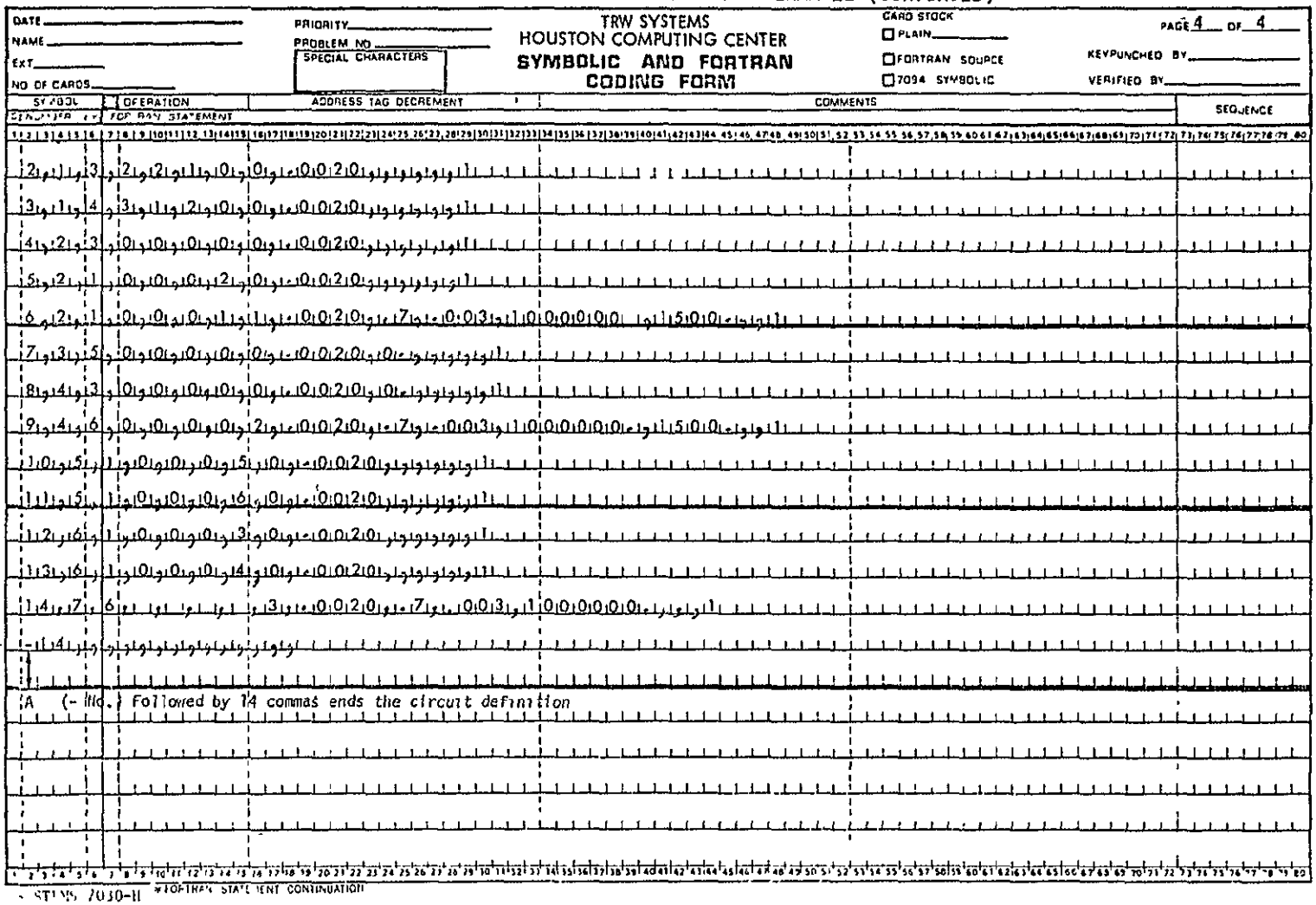


FIGURE 3-6. INPUT CARD LISTING - EXAMPLE (CONTINUED)



3.2.2 Variable Data

Input variables for Phase II are provided to extend the flexibility of the program for conducting electrical power system parametric studies and to eliminate many program modifications that would occur due to the evolution of vehicle and hardware design. Table 3-1 lists all Phase II variables with maximum dimension, input method, units, and definition.

The two methods of inputing the variable data into Phase II are by data tape and card deck. The method used by each variable is defined in Table 3-1. The values of the variables that are listed on the data tape will be overriden by card deck input. The only card deck modifications that can be made to the Phase I interface tape are the changing of a component power level at data initialization and changing a switch position during the timeline.

Figure 3-7 shows the card deck setup for inputing the initialization data. Figure 3-8 shows the individual card readout for the initialization input data for the circuit described in Figure 3-3. When the Phase I interface tape is used, the card deck input LOAD VARIABLES in Table 3-1 are not required since load values would be obtained from the interface tape timeline.

Changing the variable values through the card deck timeline input is discussed in Section 3.3.

3.3 CARD TIMELINE DATA INPUT

The card timeline provides a means of access to the Phase II program during a timeline run to inject changes at desired time point.

The type of change inputs available to the user are:

1. Load values
2. Switch position (changes circuit configuration)
3. State-of-charge on battery
4. Operating temperature of fuel cell
5. Temperature of battery

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK	UNITS	DEFINITIONS
					LOAD VARIABLES
ACPOW(I)	(9)	X	ID&CTL	WATTS	Ac load for inverter AC BUS (I), Variable not used when Phase II is driven by an interface tape
PFAC(I)	(9)	X	ID&CTL		AC load power factor for AC BUS (I) corresponding to loads in ACPOW(I). Not used with interface tape
PP(I)	(50)	X	ID&CTL	WATTS	Constant power load for LOAD (I), Variable not used when PHASE II is driven by an interface tape
PR(I)	(50)	X	ID&CTL	WATTS	Constant resistive power load for LOAD (I), PP(I) and/or PR(I) may be used to represent LOAD (I), Variable not used when PHASE II is driven by an interface load
CHRGLD	1	X	ID&CTL	WATTS	DC power required by battery charger when charging batteries

*ID = INITIALIZATION DATA

CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK	UNITS	DEFINITIONS
					LOAD VARIABLES
CVAL(I)	(25)	X	ID		Component power value to be used in PHASE II calculations in lieu of the component loads in TPLOAD. NOTE: LOC 1-5 for F/C 1-5 noncyclic loads and LOC 6-10 for F/C 1-5 cyclic loads
NCNT(I)	(25)	X	ID		Component numbers associated with the component loads in CVAL
NCTP(I)	(25)	X	ID		For each LOAD in CVAL, defines if the load is constant power (>0) or constant resistance (=0)
NCNTC		X	ID		Number of loads defined in CVAL
CAPINV	(9)	X	ID	VOLT-AMP	Inverter (I) maximum overload limit

*ID = INITIALIZATION DATA

CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK		UNITS	DEFINITIONS
						FUEL CELL VARIABLES
FCTA(I,J)	(9,7)	X	ID			Array containing fuel cell I-V curves as a function of temperature I = No. of points J = 1 is current value (amps) J = 2 thru 7 voltage level at each temperature of FCTN
FCTN(I)	(6)	X	ID			Temperatures associated with the I-V curves of FCTA
FCT(I)	(5)	X	ID&CTL			Operating temperature of fuel cell (I)
NFCTA		X	ID			No. of current points used in FCTA
H2T		X	ID		LBS	Initial quantity of hydrogen available
O2T		X	ID		LBS	Initial quantity of oxygen available
HUR		X	ID		LBS/ AMP-HR	Hydrogen use rate based on amp-hour requirements
OUR		X	ID		LBS/ AMP-HR	Oxygen use rate based on amp-hour requirements
HR		X	ID		LBS/ HR	Hydrogen purge rate
OR		X	ID		LBS/ HR	Oxygen purge rate

*ID = INITIALIZATION DATA
CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK		UNITS	DEFINITIONS
						FUEL CELL VARIABLES
HPT		X	ID		SEC	Hydrogen purge time
OPT		X	ID		SEC	Oxygen purge time
PIH		X	ID		HRS	Interval between hydrogen purges
PIO		X	ID		HRS	Interval between oxygen purges
TPH(I)	(5)	X	ID		HRS MET	Time of last hydrogen purge for fuel cell (I)
TPO(I)	(5)	X	ID		HRS MET	Time of last oxygen purge for fuel cell (I)
WPR		X	ID		LBS/ AMP-HR	Fuel cell water production rate
H2U		X	ID		LBS	Unusable hydrogen quantity
O2U		X	ID		LBS	Unusable oxygen quantity
FCLIM(I)	(3)	X	ID		WATTS	Fuel cell power limits, 1 = peak, 2 = average, 3 = minimum
TIMV(I)	(3)	X	ID		HRS	Length of time that fuel cell power limits apply, 1 = peak, 2 = average, 3 = minimum
TMAXFC		X	ID		HRS	Maximum time step thru fuel cell thermal model

*ID = INITIALIZATION DATA
CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK		UNITS	DEFINITIONS
						FUEL CELL VARIABLES
FCWP1(I)	(5)	X	ID		WATTS	Parasitic pump and logic loads for fuel cell (I) - constant power
FCWP2(I)	(5)	X	ID		WATTS	Parasitic heater cyclic load for fuel cell (I) constant resistance
SSTVI(I,J)	(10,2)	X	ID		°F/ AMP	The T-I curve which the fuel cell follows as the fuel cell temperature reaches its steady state value. J = 1 is Temp., J = 2 is current
FCLTL		X	ID		°F	Fuel cell lower temperature limit - heaters turn "ON".
FCHOL		X	ID		°F	Fuel cell high temperature limit - heater turns "OFF".
FCHTL		X	ID		°F	Fuel cell redline limit - diagnostic warning
						BATTERY VARIABLES
CSUBD(I)	(6)	X	ID		AMP-HRS	Battery amp-hour capacity for battery (I)
SOC(I)	(6)	X	ID& CTL		PER-CENT	Battery (I) initial state-of-charge

*ID = INITIALIZATION DATA
CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK		UNITS	DEFINITIONS
						BATTERY VARIABLES
TB(I)	(6)	X	ID& CTL		°F	Battery (I) temperature
XNC(I)	(6)	X	ID			Number of cells in battery I
EFFAVR		X	ID		PER-CENT	Average amp-hour efficiency during charging
SOCA(I,J,K)	(7,6,2)	X	ID			Battery I-V curves versus temperature, and battery group. I = No. of points, J = 1 is current, J = 2 to 6 voltage at temperature of IT, K = battery group 1 or 2 (1 = group of 3 common batteries) (2 = group of common batteries). (per cell voltage)
IT(I,J)	(5,2)	X	ID			Battery temperatures used in SOCA, I = temperature, J = battery group
NSOCA		X	ID			No. of points used in SOCA for each IV curve
SOCUL		X	ID			Minimum battery SOC limit

*ID = INITIALIZATION DATA

CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK		UNITS	DEFINITIONS
						DISTRIBUTION CIRCUIT VARIABLES
R(I)	(100)	X	ID		OHMS	Branch (I) line resistance
S(I)	(100)	X	ID& CTL			Branch (I) switch position (1 = closed, 0 = Open)
ICRCT(I,J)	(100,4)	X	ID			Branch (I) definition I = Branch No., J = 1 is node number current out, J = 2 is node number current in, J = 3 is source number, J = 4 is load number
NCRT		X	ID			Maximum or highest branch number in ICRCT
CRCT(I,J)	(100,6)	X	ID			Branch (I) diode or RPC definition I = Branch No., J = 1 is diode voltage drop, J = 2 is diode forward resistance, J = 3 is reverse resistance, J = 4 is RPC no load resistance, J = 5 is forward or reverse resistance being used, J = 6 is branch current limit
UV(I)	(30)	X	ID		VOLTS	Undervoltage limit for node (I)
DELTA		X	ID& CTL		VOLTS	Tolerance on node voltage solutions (normally 10^{-5})

*ID = INITIALIZATION DATA
CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK	-	UNITS	DEFINITIONS
						DISTRIBUTION CIRCUIT VARIABLES
INVLCA(I)	(9)	X X	ID& CTL			Inverter number connected to AC inverter bus (I)
NSC(I)	(12)	X	ID			Number of IV points in Source (I) used in the circuit solution
						POWER SOURCE VARIABLE (Other than Batt & F/C)
T3SRCS(I,J)	(15,2)	X	ID& CTL			Type 3 source IV curve, I = Number of points, J = 2 is current value, J = 1 is voltage value
NT3S		X	ID& CTL			Number of points used in T3SRCS
T4SRCS(I,J)	(15,2)	X	ID& CTL			Type 4 source I-V curve, I = Number of points, J = 2 is current values, J = 1 is voltage values
NT4S		X	ID& CTL			Number of points used in T4SRCS

*ID = INITIALIZATION DATA
CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD DATA TAPE	CARD* DECK		UNITS	DEFINITIONS
						MISC. VARIABLES
MET			ID		HRS	Simulation start time
TDELTA			ID& CTL		HRS	Maximum simulator time increment
NPRT			ID& CTL			Formatted printout interval as a multiple of TDELTA
JPRINT			ID			Flag to request initialization data to be printed out. Value > 1
IPRNT			CTL			Flag to request a formatted printout at a particular card timeline point. Set = 1 to request print
ISOLVC			CTL			Flag to request a circuit solution at a particular card timeline point. Set = 1 to request solution
MPRNT1			ID& CTL			Set > 0 to request tape timeline debug print
MPRNT2			ID& CTL			Set > 0 to request inverter debug print

*ID = INITIALIZATION DATA
CTL = CARD TIMELINE

TABLE 3-1. INPUT DATA VARIABLES FOR PHASE II (Cont'd)

LABEL	MAX DIM	INPUT METHOD: DATA TAPE	INPUT METHOD: CARD* DECK		UNITS	DEFINITIONS
						MISC. VARIABLES
MPRNT3			ID& CTL			Not Used
MPRNT4			ID& CTL			Set > 0 to request battery and fuel cell debug print
MPRNT5			ID& CTL			Not Used
MPRNT6			ID& CTL			Not Used
IABORT			CTL			Set > 0 to abort simulation
ICHRG(I)	(3)		CTL			Charge Flag to initiate charging of battery (I)
IRESET			CTL			A request to print SIMPAC data for simulation initialization data points.

*ID = INITIALIZATION DATA
CTL = CARD TIMELINE

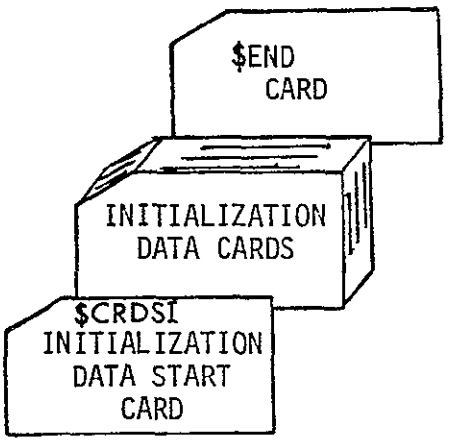
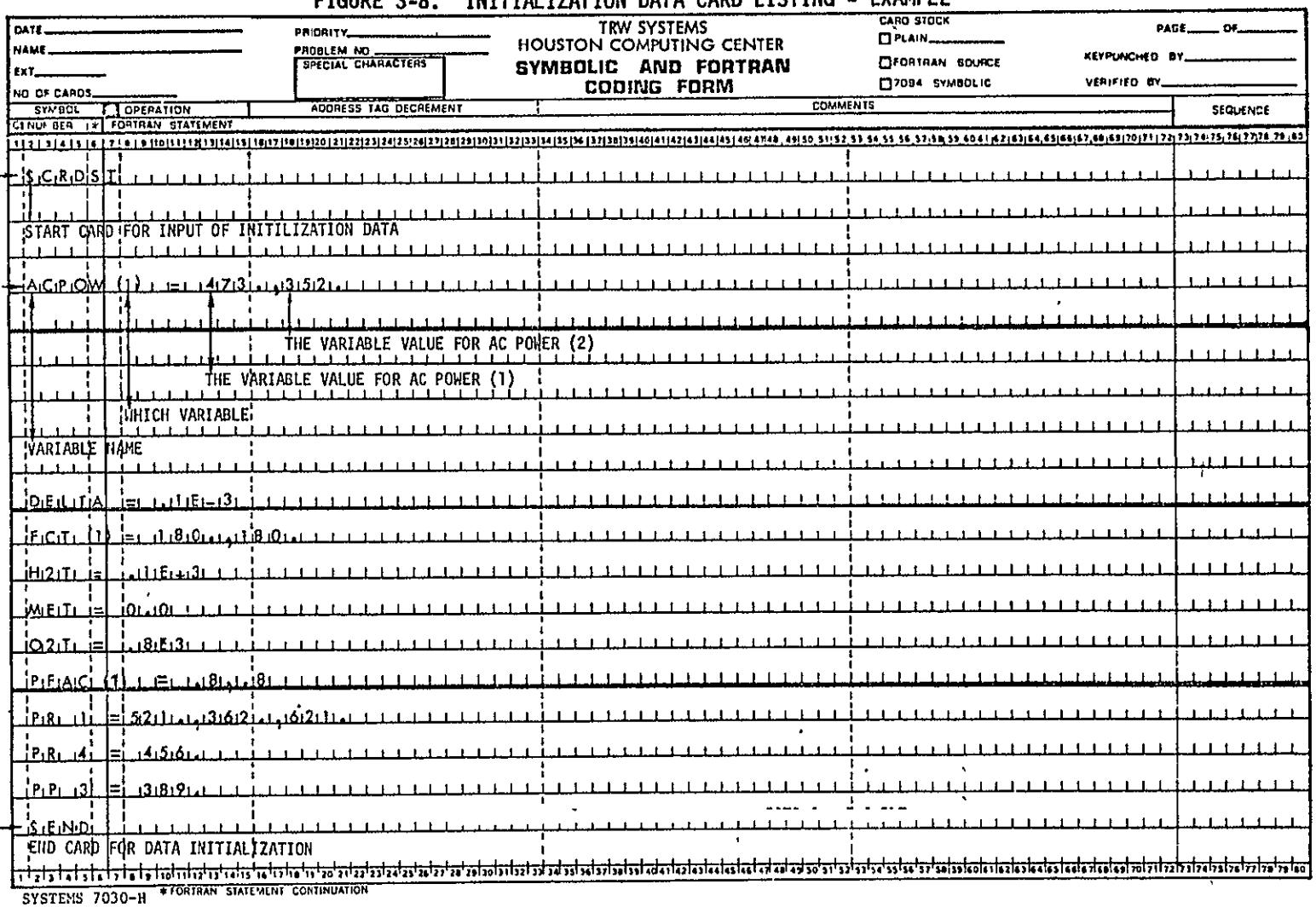


FIGURE 3-7. INITIALIZATION DECK SETUP

FIGURE 3-8. INITIALIZATION DATA CARD LISTING - EXAMPLE



6. Request additional printout for SIMPAC data and for debug
7. Abort run
8. Node voltage solution tolerance
9. Battery charger load value and initiate charging
10. Change ac bus connections to inverters
11. Request circuit solution and formatted printout
12. Change ground reference node
13. Number of points in developing "OTHER" source I-V curve
14. "OTHER" source I-V curve points
15. Maximum time step increment

The variables that can be used in the card timeline are listed in Table 3-1. The deck setup for card timeline input is shown in Figure 3-9. Example card readout for timeline input is shown in Figure 3-10.

3.4 FORMATTED PRINTOUT DESCRIPTION

The formatted printouts available from SEPS Phase II are discussed in the subsequent paragraphs of this section and examples of each type of printed output are provided. The user can select or omit the Phase II printout by proper selection of the options described on the option card (Section 4.1).

3.4.1 DC Distribution Network Status

Figure 3-11 depicts the formatted printout for the Distribution Network parameters. The length of the printout will vary as a function of the number of branches in the circuit.

3.4.2 Source Status and Cryogenic Usage

Figure 3-12 depicts the formatted printout for source status, cryo status, and inverter status. The width of the printout will vary as a function of number of sources and inverters.

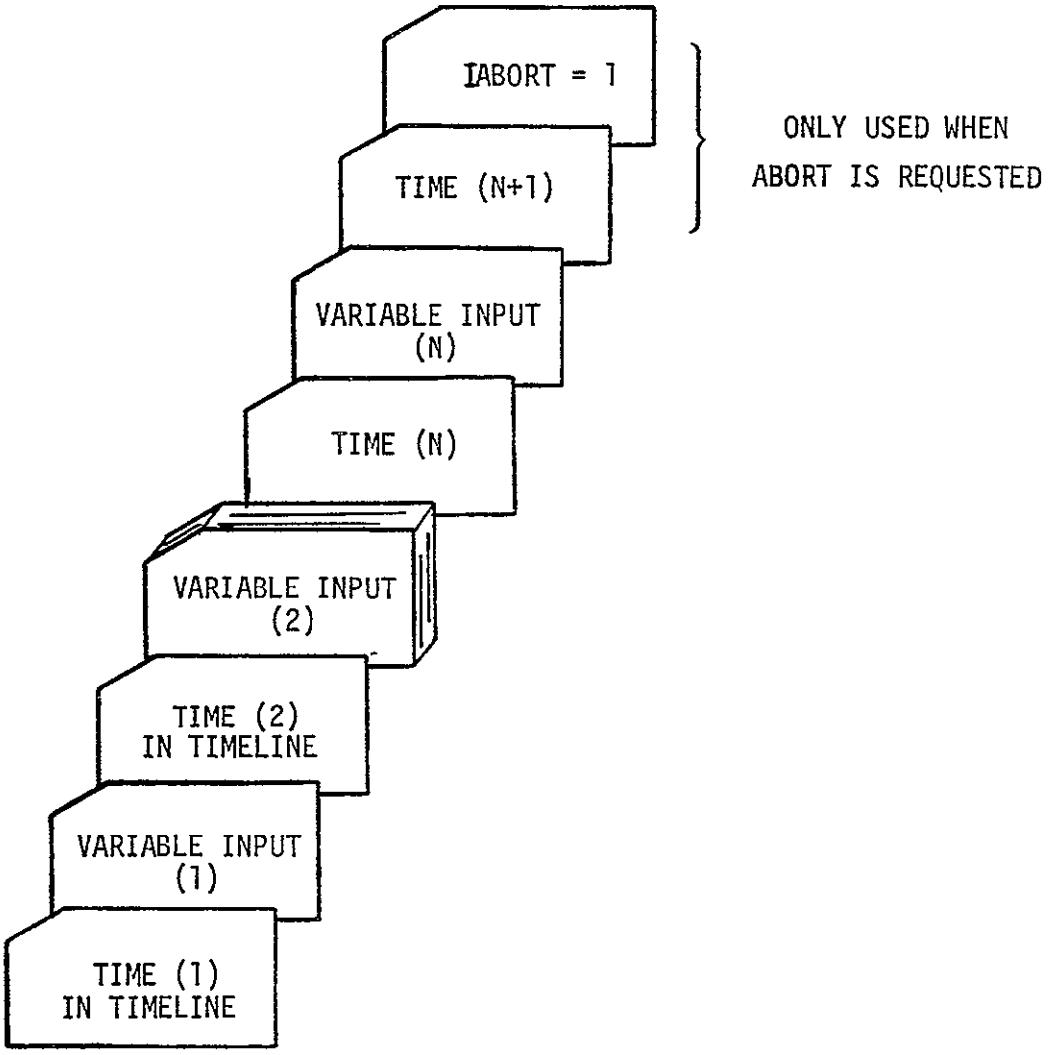


FIGURE 3-9. CARD TIMELINE DECK SETUP

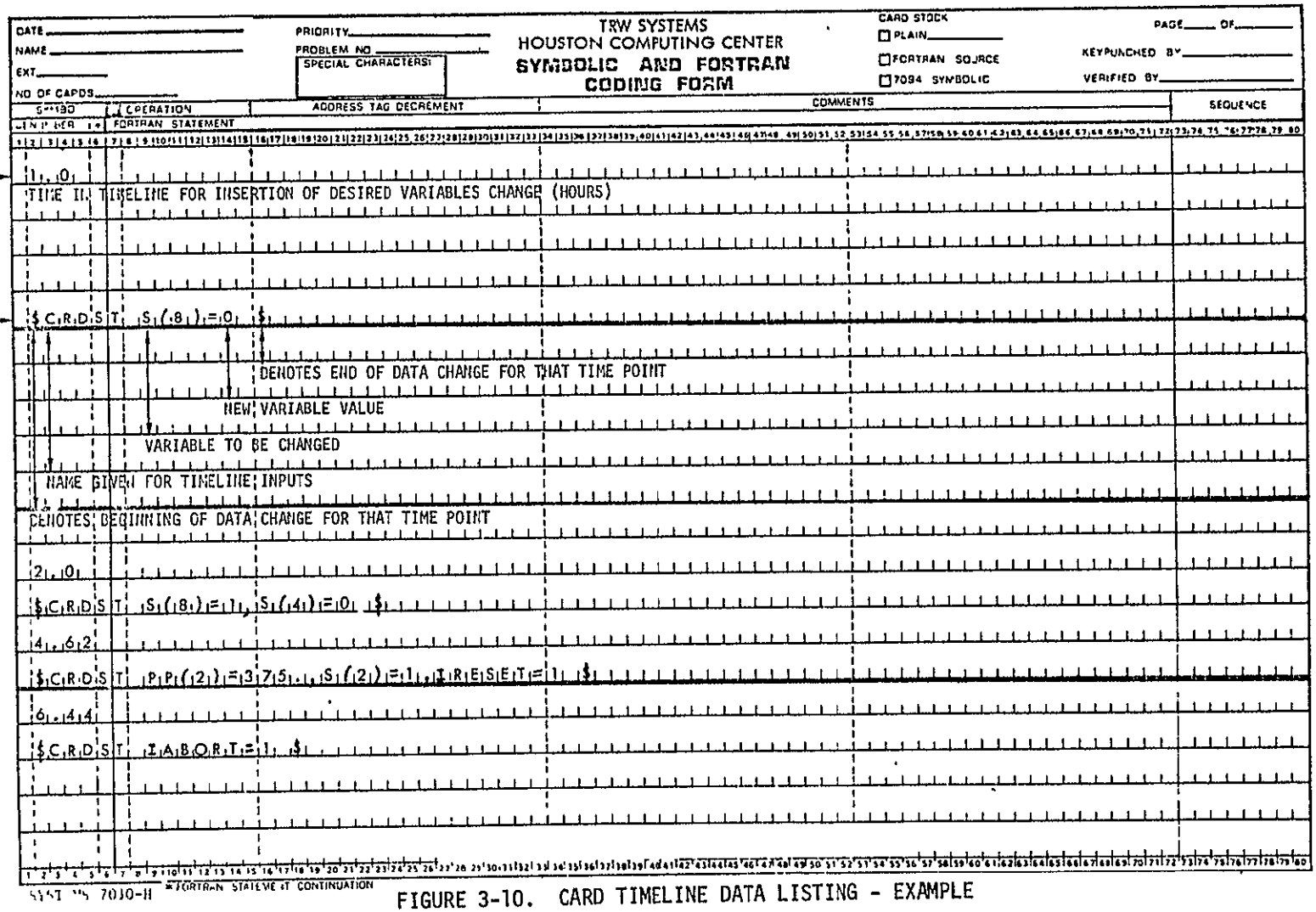


FIGURE 3-10. CARD TIMELINE DATA LISTING - EXAMPLE

FIGURE 3-11. DC DISTRIBUTION NETWORK STATUS

MISSION ELAPSED TIME 155.0000 TIME STEP .2200 NEXT INPUT TIME 155.5040

TOTAL SOURCE POWER 9032.0763 TOTAL DC/AC LOAD 8329.4440 REFERENCE NODE 27 ACCURACY .0010 SOLUTIONS ATTEMPTED 5

BRANCH NO	RN	SW	SOURCE VOLTAGE	SOURCE CURRENT	LOAD PP	LOAD PR	LOAD VOLTAGE	LOAD CURRENT	LOAD RESISTANCE	BRANCH CURRENT	BRANCH RESISTANCE	DIODE OR RPC VOLTAGE	DIODE OR RPC RESISTANCE	SHUNT
1	1	1	31.23	102.22						102.2213	.0020			
2		1								67.2523	.0135			
3		1								12.3425	.0043			
4		1								22.6261	.0043			
5		0								.0000	.0043			
6		1								.1700	.0163	.7000	.0040	.0058
7		0								.0000	.0120			
8		0								.0000	.0120			
9		1								14.4248	.0020	.7000	.0040	.0058
10		1								2.9381	.0020	.7000	.0040	.0057
13	10	1			5.0000	.0000	29.4099	.1700	172.9879	.1700	.0000			
14	9	1			328.1180	.0000	30.1134	10.8961	2.7637	10.8961	.0000			
15	8	1			.0000	.0000	29.4099	.0000	INF.	.0000	.0000			
16	7	1			509.2000	.0000	29.3268	17.3630	1.6890	17.3630	.0000			
17	47	1			.0000	1016.7063	30.1134	39.0516	.7711	39.0516	.0000			
18	6	1			80.9020	.0000	30.1134	2.6866	11.2088	2.6866	.0000			
19	3	1			382.2228	.0000	30.9682	12.3425	2.5091	12.3425	.0000			
20	4	1			.0000	.0000	30.9682	.0000	INF.	.0000	.0000			
21	5	1			.0000	.0000	30.9682	.0000	INF.	.0000	.0000			
22	1	1			240.4410	.0000	30.9240	7.7752	3.9772	7.7752	.0000			
23		1								4.1258	.0020	.7000	.0040	.0059
24		1								5.7456	.0020	.7000	.0040	.0059
25	2	1			298.1000	.0000	30.1992	9.8711	3.0593	9.8711	.0000			
26	2	1	31.21	103.25						103.2453	.0020			
27		1								71.3001	.0135			
28		1								14.8988	.0043			
29		1								17.0460	.0043			
30		0								.0000	.0043			
32		0								.0000	.0120			
33		0								.0000	.0120			
34		1								-.0000	.0020	.7000	REVERSED	.0057
35		1								6.7672	.0020	.7000	.0040	.0058
38	20	1			5.0000	.0000	.0000	.0000	20.0000	.0000	.0000			
39	19	1			191.1180	.0000	30.0444	6.3612	4.7231	6.3612	.0000			
40	18	1			.0000	.0000	.0000	.0000	INF.	.0000	.0000			
41	17	1			200.0000	.0000	29.5532	6.7673	4.3670	6.7673	.0000			
42	43	1			.0000	1189.0340	30.0444	45.5662	.6594	45.5662	.0000			
43	16	1			493.2500	.0000	30.0444	16.4174	1.8300	16.4174	.0000			
44	13	1			461.0100	.0000	30.9429	14.8988	2.0769	14.8988	.0000			
45	14	1			.0000	.0000	30.9429	.0000	INF.	.0000	.0000			
46	15	1			.0000	.0000	30.9429	.0000	INF.	.0000	.0000			
47	11	1			277.5488	.0000	30.9337	8.9724	3.4477	8.9724	.0000			

FIGURE 3-12. SOURCE AND INVERTER STATUS, AND CRYOGENIC USAGE

SOURCE	FUEL CELL 1	FUEL CELL 2	FUEL CELL 3	AUX POWER 4	AUX POWER 5	AUX POWER 6	AUX POWER 7
SWITCH CON	1	1	1	0	0	0	0
CURRENT	102.22	103.25	83.32	.00	.00	.00	.00
VOLTAGE	31.23	31.21	31.42	.00	.00	.00	.00
PARASITIC	.0000	.0000	.0000				

	BATT1	BATT2	BATT3
TEMP	180.0000	180.0000	180.0000
SOC			
AH REMAIN			

CRYOGEN USAGE

	LOADED (LBS)	REMAINING (LBS)	CONSUMED (LBS)	H2O PROD (LBS)
O2	800.00	-309.47	1109.47	1246.41
H2	100.00	-41.78	141.78	

INVERTER STATUS

INVERTER	1	2	3
AC LOAD	772.4000	908.0000	80.0000
POWER FACTOR	.9237	.9076	.9065
DC LOAD	1016.7063	1189.0340	132.6156

3.4.3 Constraint Analysis Printout

The Constraint violation printout as shown in Figure 3-13 will be provided at the end of the Phase II run if requested by the user.

3.4.4 Phase II COMUSE Printout

Phase II COMUSE Printout is the same as described for Phase I (Section 2.4) except that all power values are at the actual operating voltage rather than 28 volts.

3.5 PLOT TAPES

Phase II provides three separate plot tapes, selected at the option of the user (see 4.1 Program Option Cards), which can be used to plot selected Electrical Power System parameters as a function of mission elapsed time.

Table 3-2 defines the Shuttle plot parameters available while Table 3-3 defines the plot parameters available for ASTP CSM 111 and ASTP CSM 119.

3.6 PHASE II INTERFACE TAPE

Phase II of the SEPS program provides an interface tape, as an output, which is exactly like the Phase I interface tape (Section 2.6) except that power values are at the load operating voltages rather than at 28 volts dc. The Phase II interface tape is used as input to COMUSE to provide a load/subsystem mission phase analysis.

FIGURE 3-13. CONSTRAINT ANALYSIS PRINTOUT

CONSTRAINT ANALYSIS

CONSTRAINT TABLE DEFINITION

TYPE	DESCRIPTION	RELATIVE
1	NODE UNDER VOLTAGE	NODE
2	INVERTER OVERLOAD CAPACITY	INVERTER
3	BRANCH OVERLOAD CURRENT	BRANCH
4	FUEL CELL PEAK POWER	FUEL CELL
5	FUEL CELL AVERAGE POWER	FUEL CELL
6	FUEL CELL MINIMUM POWER	FUEL CELL
7	O2 TANKS DEPLETED	TANK
8	H2 TANKS DEPLETED	TANK
9	BATTERY SOC LESS THAN LIMIT	BATTERY

TIME	TYPE	RELATIVE NUMBER	LIMIT VALUE	ACTUAL VALUE
.00	1	2	25.5000	25.1513
.00	1	5	25.5000	24.2840
.00	1	7	25.5000	24.4296
.00	1	9	25.5000	25.0734
.00	1	12	25.5000	24.3358
.00	1	16	25.5000	25.2125
.00	1	19	25.5000	24.3846
.00	1	21	25.5000	24.5125
.00	1	22	25.5000	23.9333
.00	1	26	25.5000	25.2125
.00	2	1	1250.0000	1955.5795
.00	2	2	1250.0000	1940.7242
.00	3	2	175.0000	245.4383
.00	3	11	.0000	.0000
.00	3	12	.0000	.0000
.00	3	27	175.0000	249.6607
.00	3	36	.0000	.0000
.00	3	37	.0000	.0000
.00	3	52	175.0000	225.5228
.00	3	61	.0000	.0000
.00	3	62	.0000	.0000
.00	3	86	250.0000	259.5504
.13	3	11	.0000	.0000
.13	3	12	.0000	.0000
.13	3	36	.0000	.0000
.13	3	37	.0000	.0000
.13	3	61	.0000	.0000
.13	3	62	.0000	.0000
.33	3	11	.0000	.0000
.33	3	12	.0000	.0000
.33	3	36	.0000	.0000
.33	3	37	.0000	.0000
.33	3	61	.0000	.0000
.33	3	62	.0000	.0000
.50	3	11	.0000	.0000
.50	3	12	.0000	.0000
.50	3	36	.0000	.0000
.50	3	37	.0000	.0000

TABLE 3-2. PLOT PARAMETERS

LOCATION	QUANTITY	DEFINITION
1	1	Time
2-13	12	Source Voltages
14-25	12	Source Currents
26-37	12	Source Power
38	1	Total F/C Current
39	1	Total F/C Power
40	1	Accumulated F/C AMP-HR
41	1	Inverter No. 1 dc Load
42	1	Inverter No. 2 dc Load
43	1	Inverter No. 3 dc Load
44	1	Total Inverter dc Load
45	1	Accumulated Source KWH
46	1	O2 Consumed
47	1	H2 Consumed
48	1	O2 Remaining
49	1	H2 Remaining
50	1	H2O Produced
51-74	24	Bus (Node) Voltages

TABLE 3-3. ASTP PLOT PARAMETERS

The following are the word locations and word content for the SEPS ASTP PLOT TAPES generated for CSM 111 or CSM 119. The parameter values will be provided at each SEPS time point which includes all load changes.

WORD NO.	CSM 111 WORD CONTENT	WORD NO.	CSM 119 WORD CONTENT
1	Mission Time in Hours (GET)	1	Same as CSM 111
2	Total ac Power	2	Same as CSM 111
3	Total dc Power	3	Same as CSM 111
4-6	Power Out of Fuel Cells 1-3	4-5	Power Out of Fuel Cells 1-2
7	Total Fuel Cell Power	6	Same as CSM 111
8-10	Fuel Cell 1-3 Current	7-8	Fuel Cell 1-2 Current
11-13	Fuel Cell 1-3 Voltage	9-10	Fuel Cell 1-2 Voltage
14-16	Battery A,B,C Current	11-14	Battery A,B,C Descent Current
17-19	Battery A,B,C Voltage	15-18	Battery A,B,C, Descent Voltage
20-22	Battery A,B,C Ampere Hours	19-22	Battery A,B,C, Descent Ampere Hr
23-25	Fuel Cell 1-3 Temperature	23-24	Fuel Cell 1-2 Temperature
26	Total dc Energy Used	25	Same as CSM 111
27	Quantity H2 Remaining Tank 1	26	
28	Quantity H2 Remaining Tank 2	27	
29	Quantity O2 Remaining Tank 1	28	
30	Quantity O2 Remaining Tank 2	29	
31	Total Fuel Cell Current	30	
32	Total Battery Current	31	
33	Total Spacecraft Current	32	
34	Percent O2 Remaining Tank 1	33	
35	Percent O2 Remaining Tank 2	34	
36	Percent H2 Remaining Tank 1	35	
37	Percent H2 Remaining Tank 2	36	
38	CM Main Bus A Voltage	37	
39	CM Main Bus B Voltage	38	
40-42	Fuel Cell (1-3) Internal Resistance	39-41	
43,44	Main Bus A &B Power	42-43	

4.0 PHASE I/PHASE II RUN PROCEDURES

4.0 PHASE I/PHASE II RUN PROCEDURES

4.1 PROGRAM OPTION CARDS

There are two option cards and one abort card that are used to define program operation. The first option card is used to request what type of analysis is to be performed and the output data to be obtained. The options are dependent on the "flags" set on this card. See Table 4-1 for option card format.

The second card is a "units" card. This card tells the program where the data required for Phase I and Phase II analysis can be located (i.e., circuit description, fixed data, etc.). The "units" card works in conjunction with where the user has assigned the tapes and the card deck inputs. The assignment location is based on the "1108 I/O UNITS" definition. The "units" card format is given in Table 4-2.

The abort card tells the program at what time to cease timeline analysis. The abort card format is given in Table 4-3. If the abort card is not used, the program will use an abort time of 500 hours.

Figure 4-1 shows a sample listing of the option card, units card, and abort card.

4.2 PHASE I DECK SETUP

4.2.1 Tape Assignments

The first cards to appear in the deck after the run card are those which assign the tapes necessary for a Phase I execution to appropriate tape units. Those tapes which must be assigned for Phase I are:

1. PCF Tape
2. SEPS Data Base Tape
3. Working Tapes (or Fastrand) - unit "0" (not zero) must be assigned and another for JVMMPS timeline
4. Tape for Dictionary and Interface

Other units can be assigned tapes to obtain optional analysis. E.g., Unit for Plot Tape - to obtain time versus power plot.

TABLE 4-1

OPTION CARD FORMAT

CARD COL		PURPOSE
1	> 0	Execute Phase I
	= 0 or blank	Do not execute Phase I
2	> 0	Execute Phase II
	= 0 or blank	Do not execute Phase II
3	> 0	Plot on Printer 1
	= 0 or blank	Do not plot on Printer 1
4	Not Used	
5	> 0	Use 3 point load data
	= 0 or blank	Do not use 3 point load data
6 - 9	Not Used	
10	> 0	Print each Phase II timepoint
	= 0 or blank	Do not print each Phase II Timepoint
11 - 19	Not Used	
20	> 0	Execute Phase II COMUSE
	= 0 or blank	Do not execute COMUSE
21 - 28	Not Used	
29	> 0	Suppress analysis part 1
	= 0 or blank	Do not suppress analysis part 1
30	> 0	Execute Phase I COMUSE
	= 0 or blank	Do not Execute Phase I COMUSE
31	> 0	Print Out Input Components
	= 0 or blank	No action taken

TABLE 4-1 (CONTINUED)

OPTION CARD FORMAT

CARD COL		PURPOSE
32	> 0	Print out input procedures
	= 0 or blank	No action taken
33	> 0	Print out input activities
	= 0 or blank	No action taken
34	> 0	Print out input timeline
	= 0 or blank	No action taken
35	> 0	Suppress COMUSE component analysis
	= 0 or blank	Do not suppress COMUSE comp. analysis
36	> 0	At the end of each mission phase Provide a Listing of all active components
	= 0 or blank	No action taken
37	> 0	Mission Phase analysis
	= 0 or blank	No Mission Phase analysis
38	> 0	Suppress cycled component listing
	= 0 or blank	Do not suppress cycled component listing ,
39	> 0	Suppress print of compacted dictionary
	= 0 or blank	Do not suppress compacted dictionary printout
40	> 0	Suppress subsystem analysis at each time point
	= 0 or blank	Do not suppress subsystem analysis
41 - 60	Not Used	

TABLE 4-1 (CONTINUED)

OPTION CARD FORMAT

CARD COL		PURPOSE
61-65	REAL NO.	Dead Band Width, $\Delta t1$, for Phase I. All Timeline events which occur within the Interval from t to t + $\Delta t1$ will be grouped together and be made to occur at Time = t.
66-70	REAL NO.	$\Delta t2$ - maximum allowable time step Phase II. (HR)
71-75	INTEGER	Phase II print control - print out will be provided at every Δtp multiple of $\Delta t2$
76-79	NOT USED	
80	INTEGER	Print Control Flag JPRINT $\leq$ 1 Not Operative $>$ 2 Print Initialization Data

TABLE 4-2

UNITS CARD FORMAT

COLUMNS 1 THROUGH 48 CONTAIN CERTAIN PROVISIONS TO DEFINE THE UNIT AND FILE FOR 12 DATA FILES. EACH DATA FILE REQUIRES FOUR COLUMNS. THE FIRST TWO ARE FOR THE UNIT NUMBER AND THE REMAINING TWO COLUMNS ARE FOR THE FILE NUMBER.

COLUMN	1-2	UNIT NUMBER FOR COMPONENTS
COLUMN	3-4	FILE NUMBER FOR COMPONENTS
COLUMN	5-6	UNIT NUMBER FOR PROCEDURES
COLUMN	7-8	FILE NUMBER FOR PROCEDURES
COLUMN	9-10	UNIT NUMBER FOR ACTIVITIES
COLUMN	11-12	FILE NUMBER FOR ACTIVITIES
COLUMN	13-14	UNIT NUMBER FOR TIMELINE
COLUMN	15-16	FILE NUMBER FOR TIMELINE
COLUMN	17-18	UNIT NUMBER FOR FIXED DATA
COLUMN	19-20	FILE NUMBER FOR FIXED DATA
COLUMN	21-22	NOT USED
COLUMN	23-24	NOT USED
COLUMN	25-26	NOT USED
COLUMN	27-28	NOT USED
COLUMN	29-30	UNIT NUMBER FOR INTERFACE PHASE I
COLUMN	31-32	FILE NUMBER FOR INTERFACE PHASE I

TABLE 4-2 (CONTINUED)

UNITS CARD FORMAT

COLUMNS 1 THROUGH 48 CONTAIN CERTAIN PROVISIONS TO DEFINE THE UNIT AND FILE FOR 12 DATA FILES. EACH DATA FILE REQUIRE FOUR COLUMNS. THE FIRST TWO ARE FOR THE UNIT NUMBER AND THE REMAINING TWO COLUMNS ARE FOR THE FILE NUMBER.

COLUMN	33-34	UNIT NUMBER FOR PLOT PHASE I
COLUMN	35-36	FILE NUMBER FOR PLOT PHASE I
COLUMN	37-38	UNIT NUMBER FOR INTERFACE PHASE II
COLUMN	39-40	FILE NUMBER FOR INTERFACE PHASE II
COLUMN	41-42	UNIT NUMBER FOR PLOT PHASE II
COLUMN	43-44	FILE NUMBER FOR PLOT PHASE II
COLUMN	45-46	UNIT NUMBER FOR DICTIONARY
COLUMN	47-48	FILE NUMBER FOR DICTIONARY
COLUMN	49-50	UNIT NUMBER FOR CIRCUIT DEFINITION
COLUMN	51-52	FILE NUMBER FOR CIRCUIT DEFINITION
COLUMN	53-54	UNIT NUMBER FOR CONSTRAINTS
COLUMN	55-56	FILE NUMBER FOR CONSTRAINTS
COLUMN	57-58	UNIT NUMBER FOR SUBSYSTEM DEF
COLUMN	59-60	FILE NUMBER FOR SUBSYSTEM DEF
COLUMN	61-62	UNIT NUMBER FOR MISSION PHASES
COLUMN	63-64	FILE NUMBER FOR MISSION PHASES

TABLE 4-3

ABORT CARD

The format of the ABORT card is as follows:

COLUMN	PURPOSE
1-10	BLANK
11-20	ABORT TIME IN DECIMAL HOURS

The time given is that at which the processing of timeline is to terminate. If this card is omitted, the abort time is set to 500 hours.

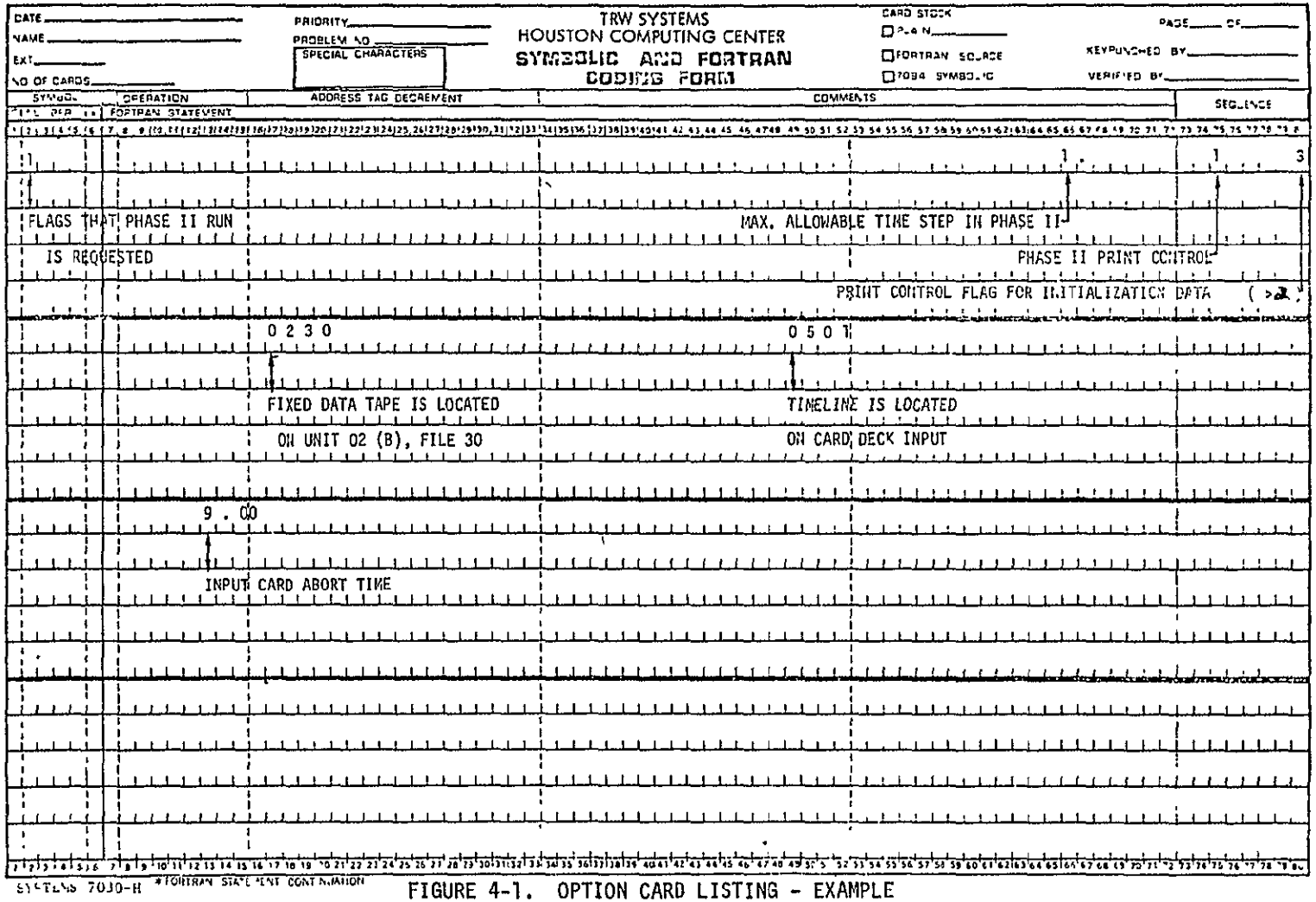


FIGURE 4-1. OPTION CARD LISTING - EXAMPLE

4.2.2 CUR

The execution of program CUR at the beginning of a SEPS run serves to load the PCF tape into core.

4.2.3 WLCCIT

The execution of program WLCCIT is not a prerequisite to a SEPS execution. It is used only as a means of making changes to the SEPS data tape when necessary or when creating a new data tape. The changes are made file by file and in order as the files appear on the data tape. A new tape is made from input card files. Refer to Appendix G for a detailed explanation of WLCCIT.

4.2.4 JVMMPS

The execution of program JVMMPS creates a detailed mission timeline. It takes designated files from the data tape which contain timeline blocks (described in the timeline section) and puts them together in time sequence to form a mission timeline for Phase I analysis by SEPS. Refer to Appendix G for detailed explanation of JVMMPS.

4.2.5 SEPS

The first card following the "execute" card is an option card. The type of analysis performed and the output obtained depend on the "flags" set on this card.

E.g., 1 in Col 1 - execute Phase I analysis
1 in Col 30 - execute COMUSE

The option card format is presented in Table 4-1.

The next card encountered is a "units" card. This card tells the program which tape unit and which file contain the data required for Phase I analysis. Units card format is given in Table 4-2.

The third card usually encountered is the mission abort card. It contains a single time at which the analysis must cease.

Mission phase cards, if used, are next encountered. These phases correspond to "phases" obtained from Mission documentation. They contain the following information:

1. Card identifier - "MM"
2. Dead band width - if different from that on option card
3. Mission Phase End - in decimal hours
4. Mission Phase Title

The card format is given in Table 4-4. The data also can be included on the data tape as a separate file. These data are then input through the "units" card.

Appendices A, B, and C provide examples of Phase I run decks for 1) saving no output tapes, 2) using WLCCIT, and 3) saving interface and plot output tapes.

4.3 DECK SETUP FOR PHASE II RUN AND PHASE I/PHASE II RUNS

The deck setup shown in Figure 4-2 is used for all Phase II runs. The option and units cards direct the program in selecting the timeline mode (if interface tape is used or not used). The following subsections discuss the major building blocks of the deck setup and define what information is required

TABLE 4-4
MISSION PHASE CARD(S)

THE FORMAT OF THE MISSION PHASE CARDS IS AS FOLLOWS

CARD COLUMN		PURPOSE
1-2	MM	DEFINE THIS CARD AS A MISSION PHASE CARD
3-5		BLANK
6-10		DEAD BAND WIDTH, Δt_j, PER THIS MISSION PHASE IF VALUE = 0 USE Δt_j FROM OPTION CARD.
11-20		MISSION PHASE END TIME IN DECIMAL HOURS.
21-56		MISSION PHASE TITLE

THE TIME IS GIVEN AT WHICH THIS MISSION PHASE IS TO END. THE CARDS MUST BE IN ASCENDING TIME ORDER. THIS GROUP OF CARDS MUST BE TERMINATED BY A CARD WITH 'EE' IN CARD COLUMNS 1-2. THE PURPOSE OF THESE CARDS IS TO SEPARATE THE TIMELINE INTO DEFINED MISSION PHASES AND IS UTILIZED IN THE DEVELOPMENT OF THE COMUSE ANALYSIS.

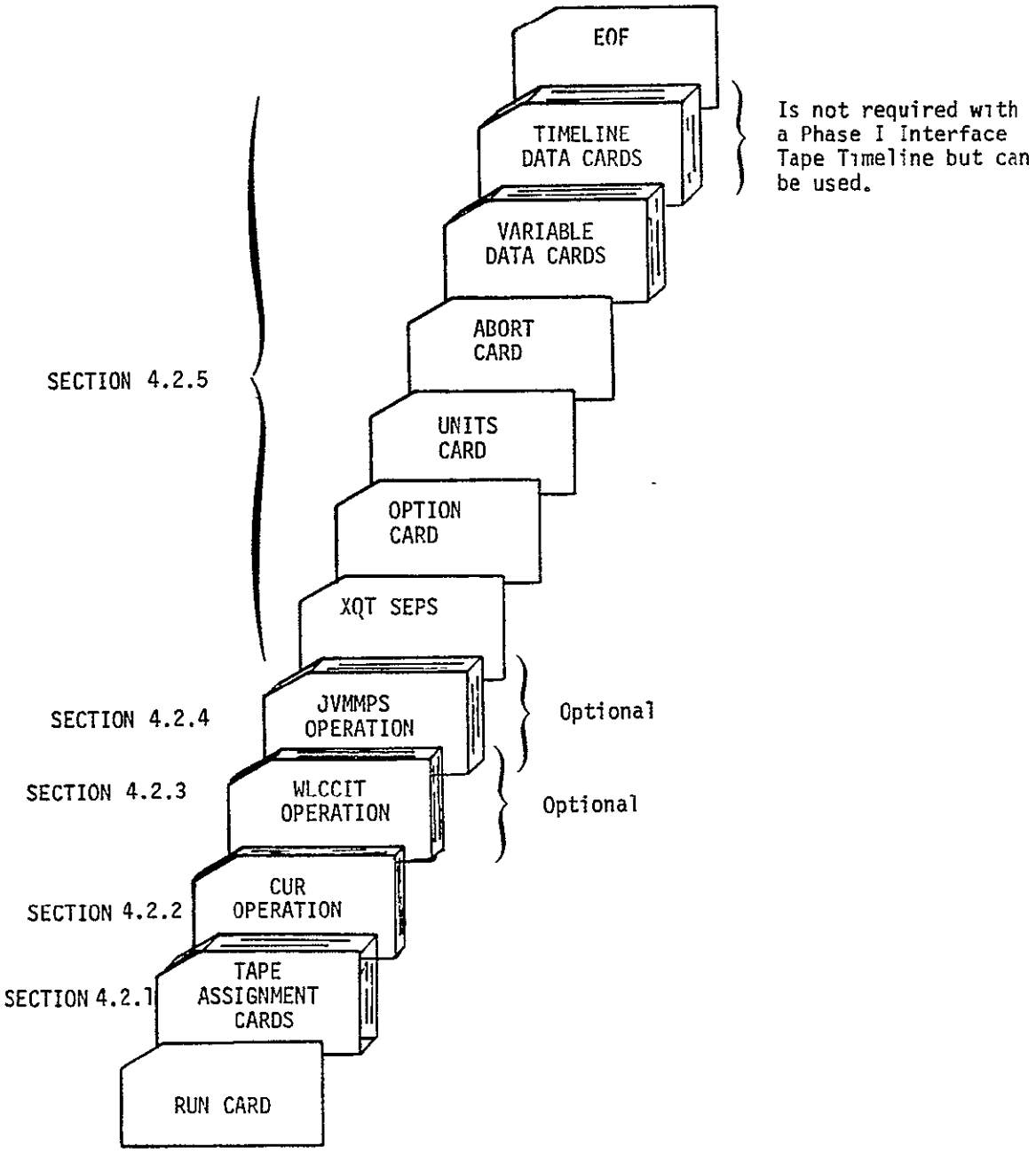


FIGURE 4-2

COMPLETE DECK SETUP FOR PHASE I/PHASE II RUN

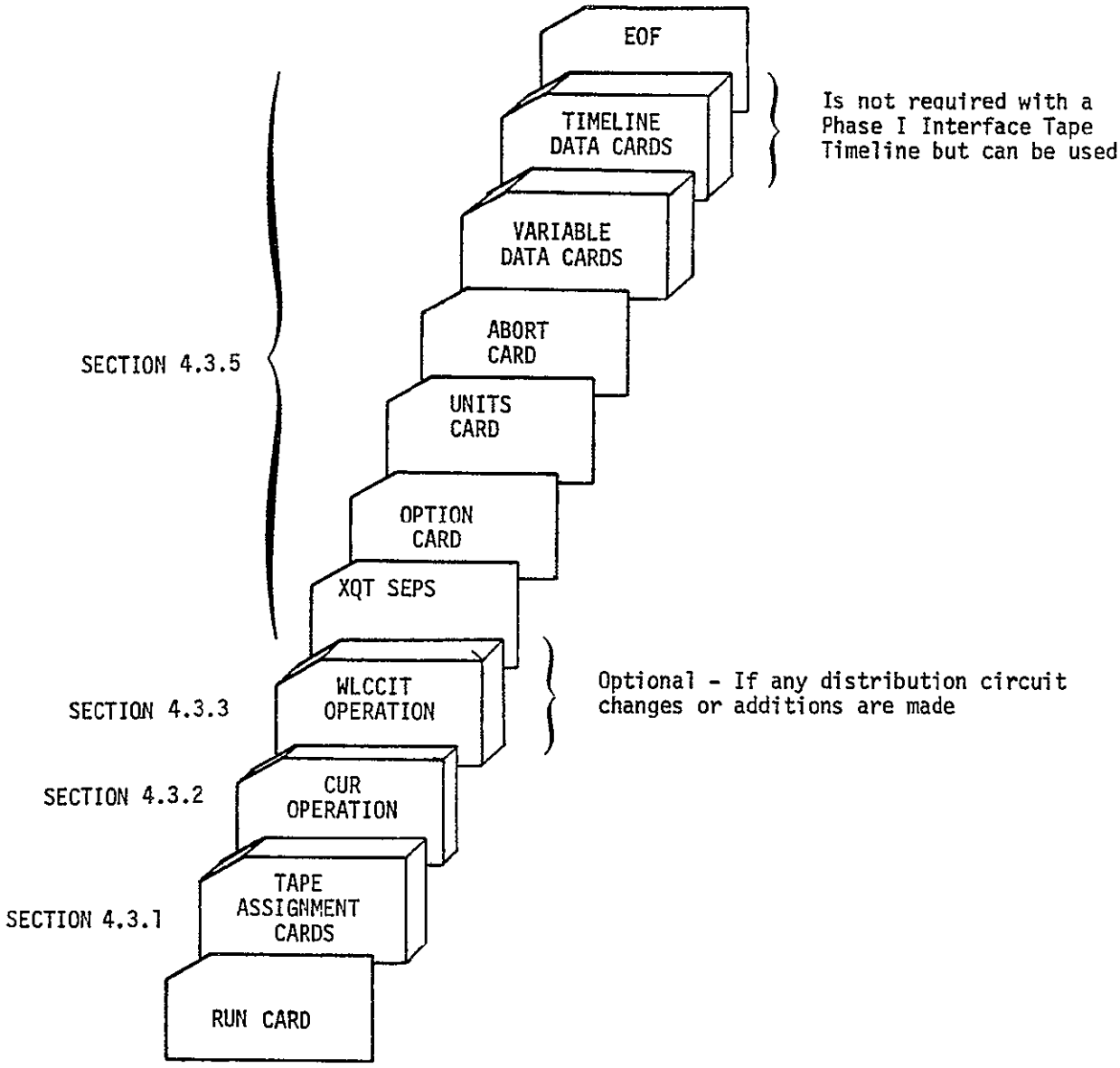


FIGURE 4-2 (CONTINUED)

COMPLETE DECK SETUP FOR PHASE II OR PHASE II
WITH PHASE I INTERFACE TAPE RUN

in each block to conduct an interface tape timeline run or a card deck timeline run. To incorporate both the interface tape and card deck timeline inputs to be used in one run the interface tape deck setup with appropriate information is used with only the addition of the card deck timeline input.

4.3.1 Tape Assignments

The first cards to appear in the deck after the run card are those which assign the tapes necessary for a Phase II execution to appropriate units. The tapes which must be assigned for PHase II without interface tape are:

1. PCF Tape
2. SEPS Data Base Tape
3. Working tape - unit "P" must be assigned to a work tape for Phase II

The tapes which must be assigned for Phase II with interface tape are:

1. PCF Tape
2. SEPS Data Tape
3. Working Tape - unit "P"
4. Interface Tape with compacted dictionary

The tapes which must be assigned for Phase I/Phase II run are:

1. PCF Tape
2. SEPS Data Tape
3. Working Tape unit "P" for Phase II (could be Fastrand)
4. Interface tape and compacted dictionary for Phase I output
5. Working Tape - Unit "O" for Phase I (could be Fastrand)
6. JVVMPS (if used)
7. WLCCIT (if data changes are made to SEPS data tape)

Other units can be assigned tapes to obtain optional analysis:

1. Phase II interface tape (required for Phase II COMUSE)
2. Plot tapes for Phase I and II
3. Constraints data storage

Figure 4-3 shows an example listing of the tape assignment cards.

4.3.2 CUR

The execution of CUR serves to load the PCF tape into core. Figure 4-3 shows an example of the cards listing CUR.

4.3.3 WLCCIT

The execution of program WLCCIT is not a prerequisite to a SEPS execution. It is used as a means of making changes or additions to the SEPS data tape. The changes are made file by file and in order as the files appear on the data tape. See Figure 4-4 for explanation of WLCCIT input cards. Additional information concerning WLCCIT is contained in Appendix G.

4.3.4 JVMMPS

The execution of program JVMMPS creates a detailed mission timeline. It takes designated files from the data tape which contain timeline blocks (described in the timeline section) and puts them together in time sequence to form a mission timeline for Phase I analysis by SEPS. The cards for JVMMPS would only be required if Phase I is run for developing an interface tape timeline. Additional information concerning JVMMPS is contained in Appendix G.

4.3.5 SEPS

The first three cards following XQT SEPS are the options, units and abort cards which are discussed in Section 4.1 and 4.2. Examples of the cards used for a card timeline run are shown in Figure 4-1. The next group of cards are for fixed data changes and data initialization. The data cards are discussed in Section 3.2 and example listing of the cards are shown in Figure 3-8. The final group of cards are the timeline cards. These cards are discussed in Section 3.3 and example listings of the cards are shown in Figure 3-10.

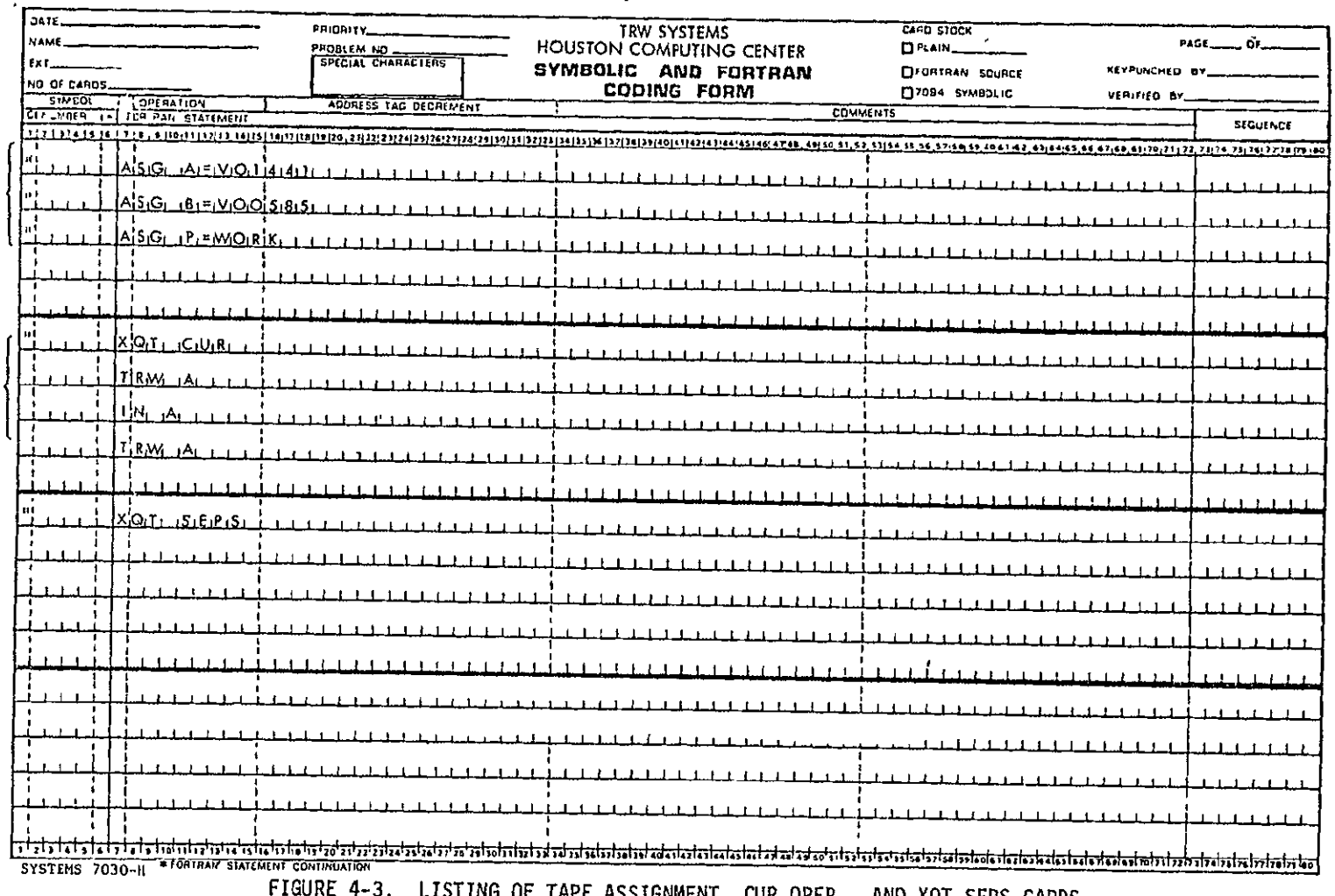
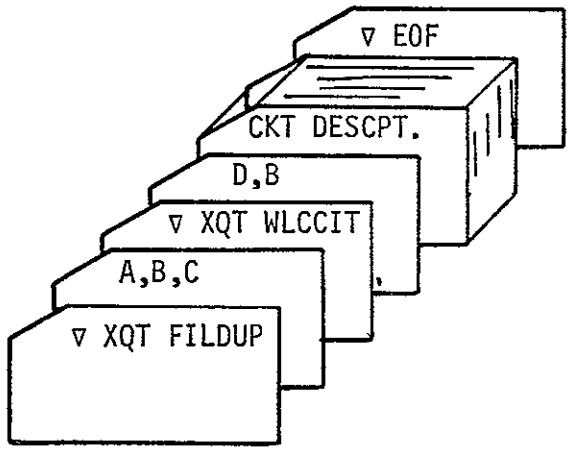


FIGURE 4-3. LISTING OF TAPE ASSIGNMENT, CUR OPER., AND XQT SEPS CARDS

FIGURE 4-4

BUILD NEW DATA FILE WITH CIRCUIT DESCRIPTION INPUT



Card 1: Execute FILDUP

Card 2: Units Card

A = Unit where data tape is located

B = Unit where new change tape is located

C = Is number of files to be copied on new tape. (new circuit will be stored in next file)

Card 3: Execute WLCCIT

Card 4: Units Card

D = Card reader input with circuit description data on cards

B = Unit where new change tape is located

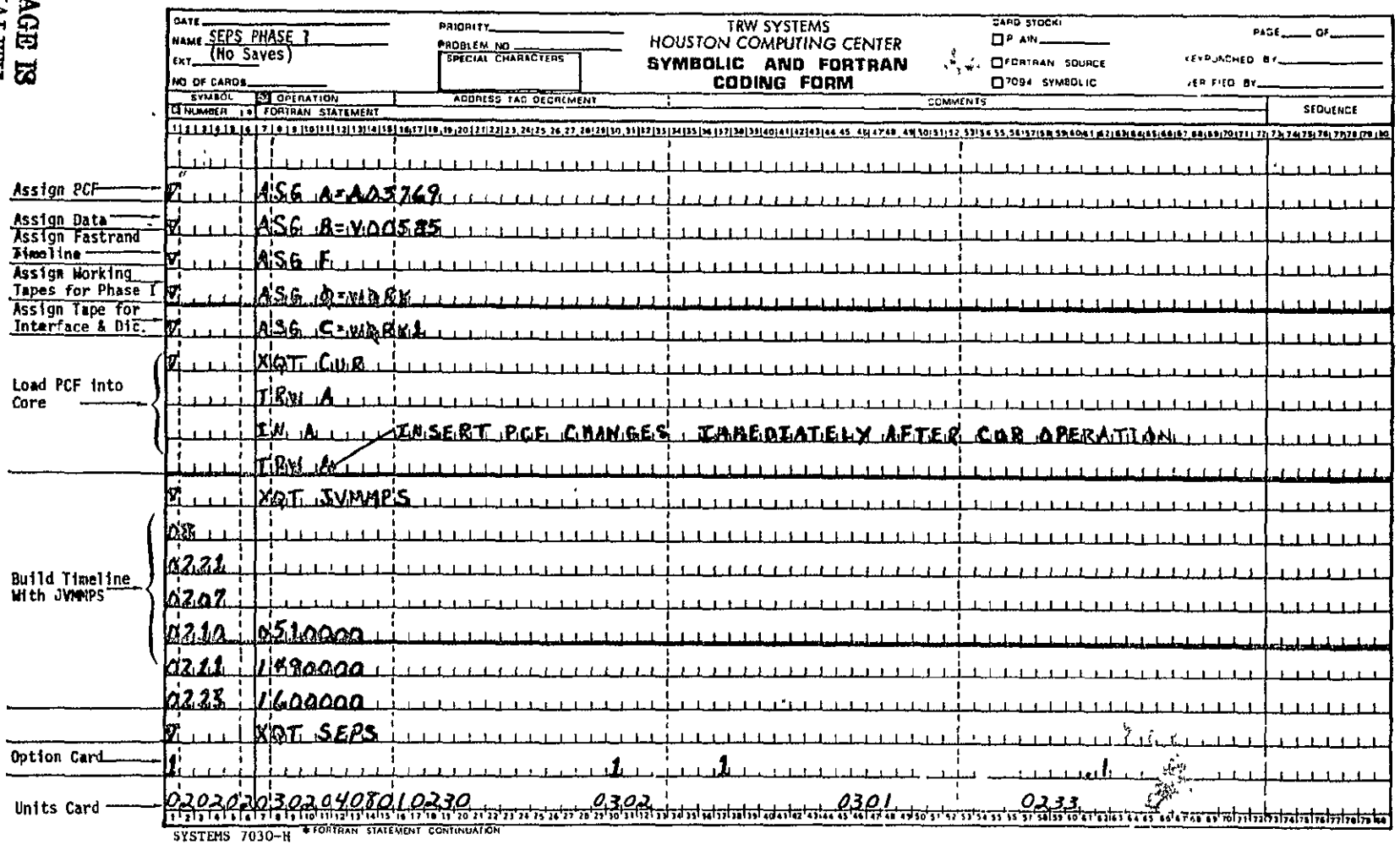
Card 5 — N: Circuit Description Cards

Cards that define circuit

Card N + 1: End of File Card

APPENDIXES

APPENDIX A



DATE
NAME SEPS PHASE 1
EXT. (No Saves)
NO OF CARDS
PRIORITY
PROBLEM NO
SPECIAL CHARACTERS

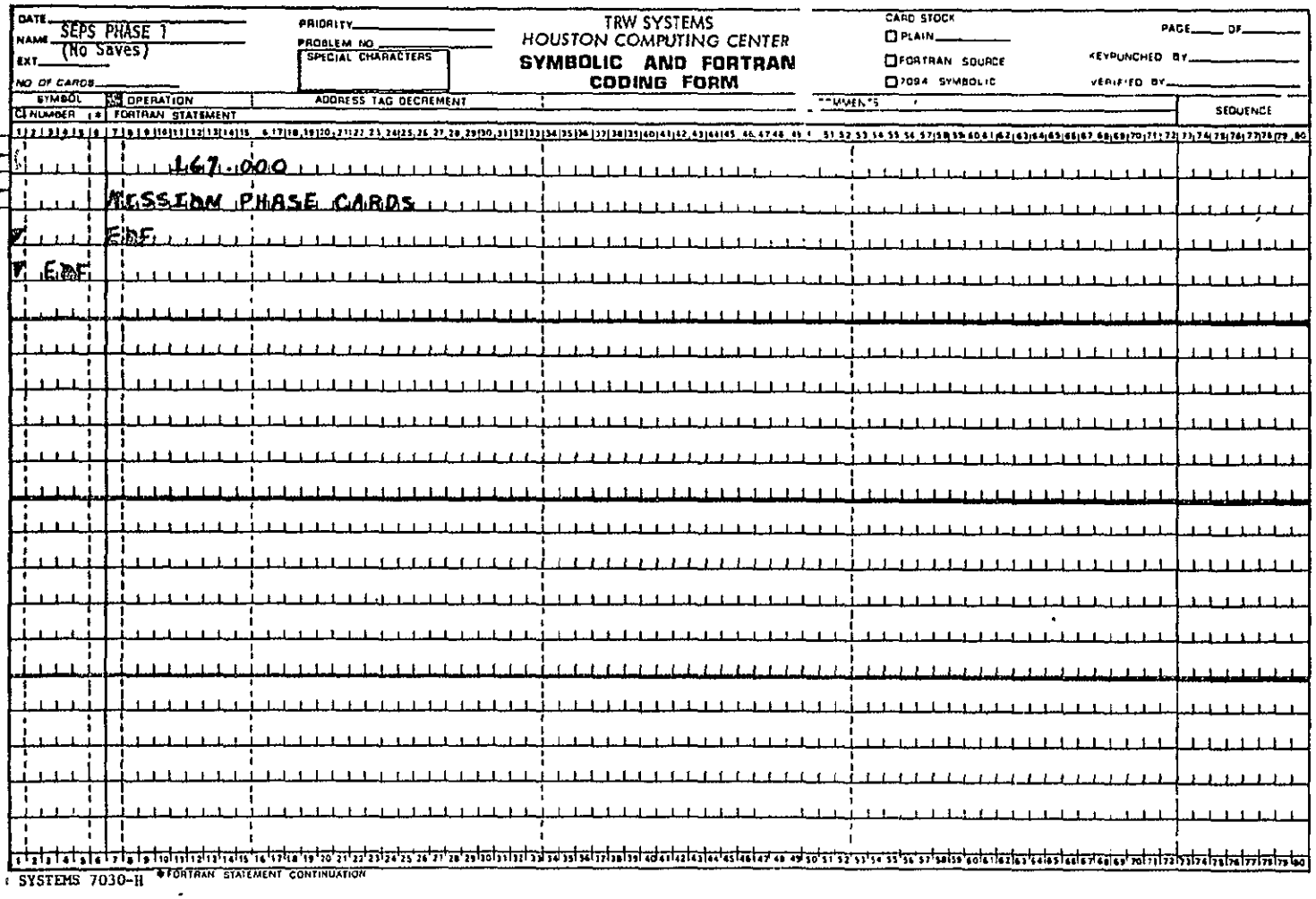
TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN CODING FORM

CARD STOCK
☐ P AIN
☐ FORTRAN SOURCE
☐ 7094 SYMBOLIC

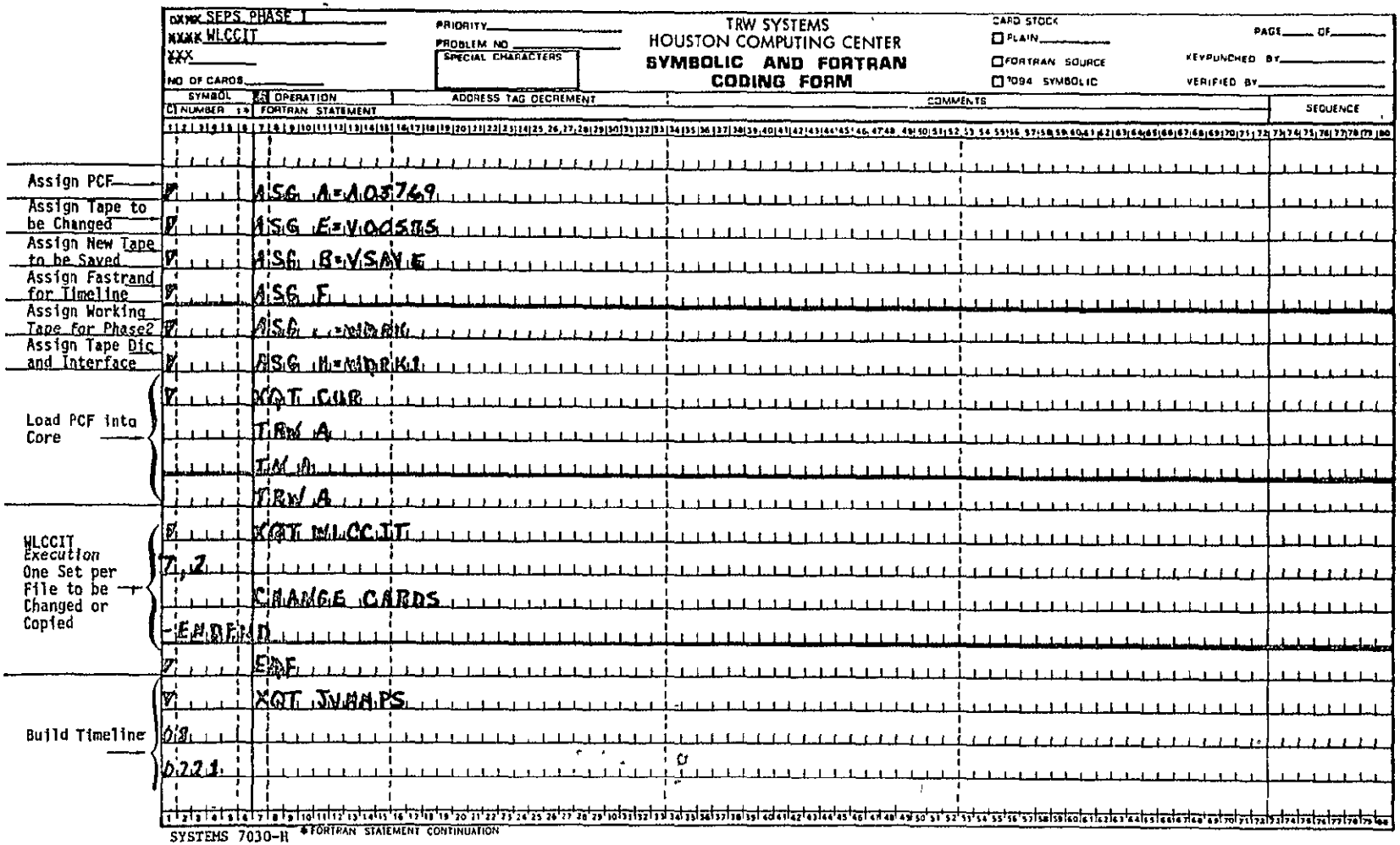
PAGE OF
KEYPUNCHED BY
VERIFIED BY

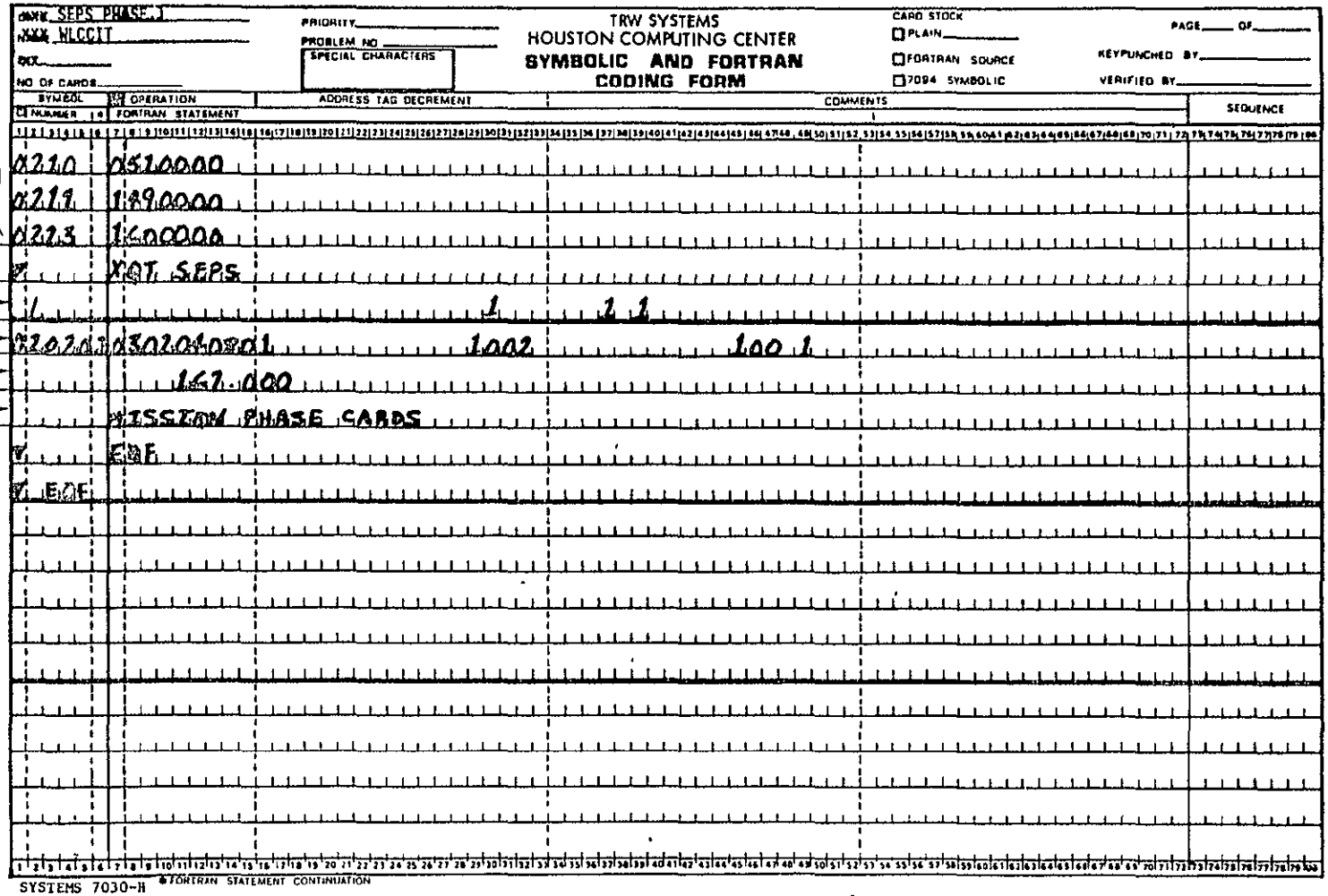
SYMBOL	OPERATION	ADDRESS TAG DECREMENT	COMMENTS	SEQUENCE
NUMBER	FORTRAN STATEMENT			
	ASG A=A05769		Assign PCF	
	ASG B=V00585		Assign Data	
	ASG F		Assign Fastrand	
	ASG D=WORK		Timeline	
	ASG C=WORK1		Assign Working Tapes for Phase I	
	XQT CUR		Assign Tape for Interface & Dic.	
	TRW A		Load PCF into Core	
	IN A	INSERT PCF CHANGES IMMEDIATELY AFTER CUR OPERATION		
	TRW A			
	XQT JVMMPS			
	08		Build Timeline With JVMMPS	
	0221			
	0207			
	0210	0510000		
	0211	1490000		
	0233	1600000		
	XQT SEPS			
1		1 1 1	Option Card	
02020	20302040801 0230	0302 0301 0233	Units Card	

SYSTEMS 7030-N * FORTRAN STATEMENT CONTINUATION



APPENDIX B





APPENDIX C

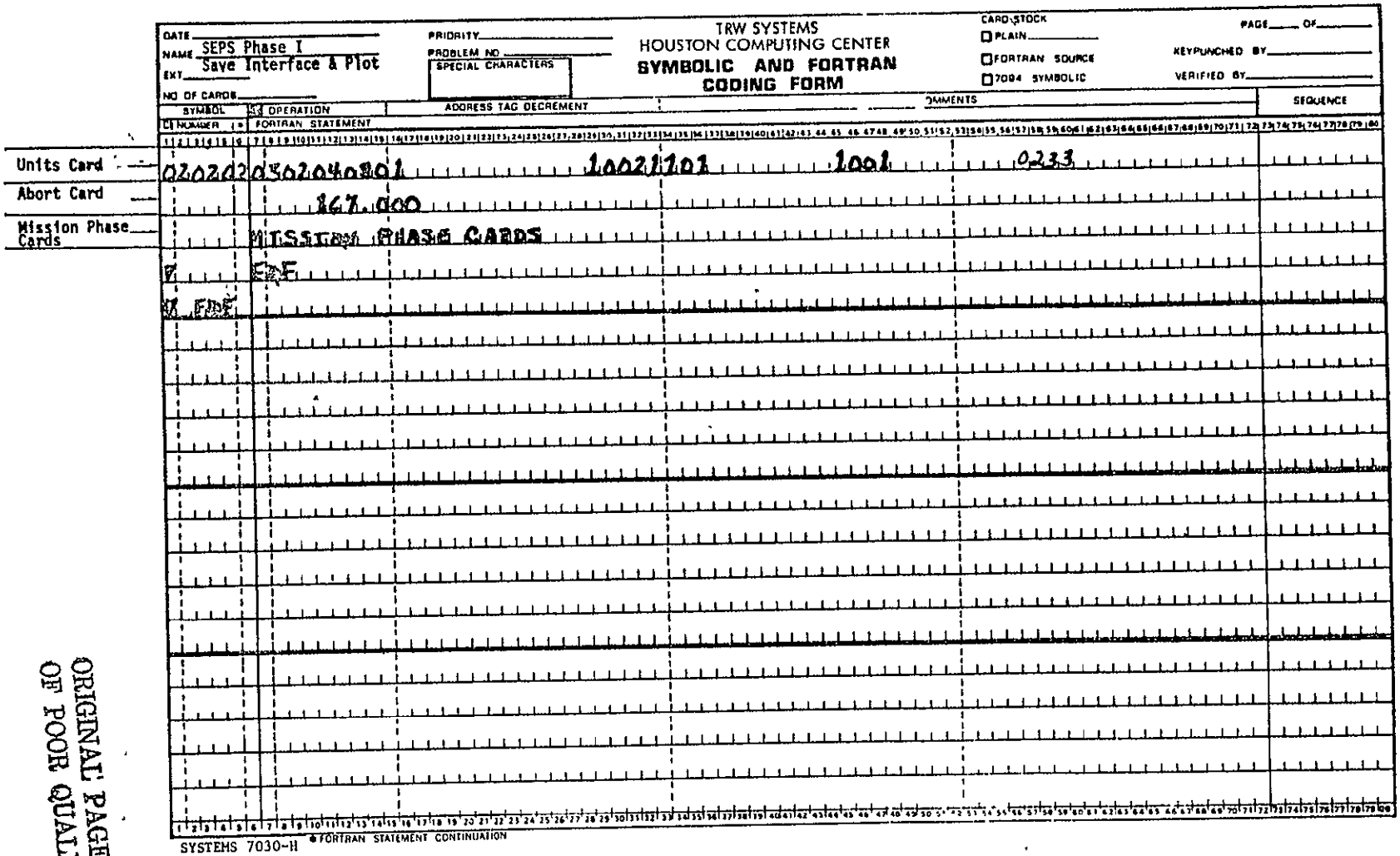
DATE
NAME SEPS Phase I
EXT Save Interface and Plot
NO OF CARDS
PRIORITY
PROBLEM NO
SPECIAL CHARACTERS

TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN CODING FORM

CARD STOCK ☐ PLAIN ☐ FORTRAN SOURCE ☐ 7094 SYMBOLIC
PAGE OF
KEYPUNCHED BY
VERIFIED BY

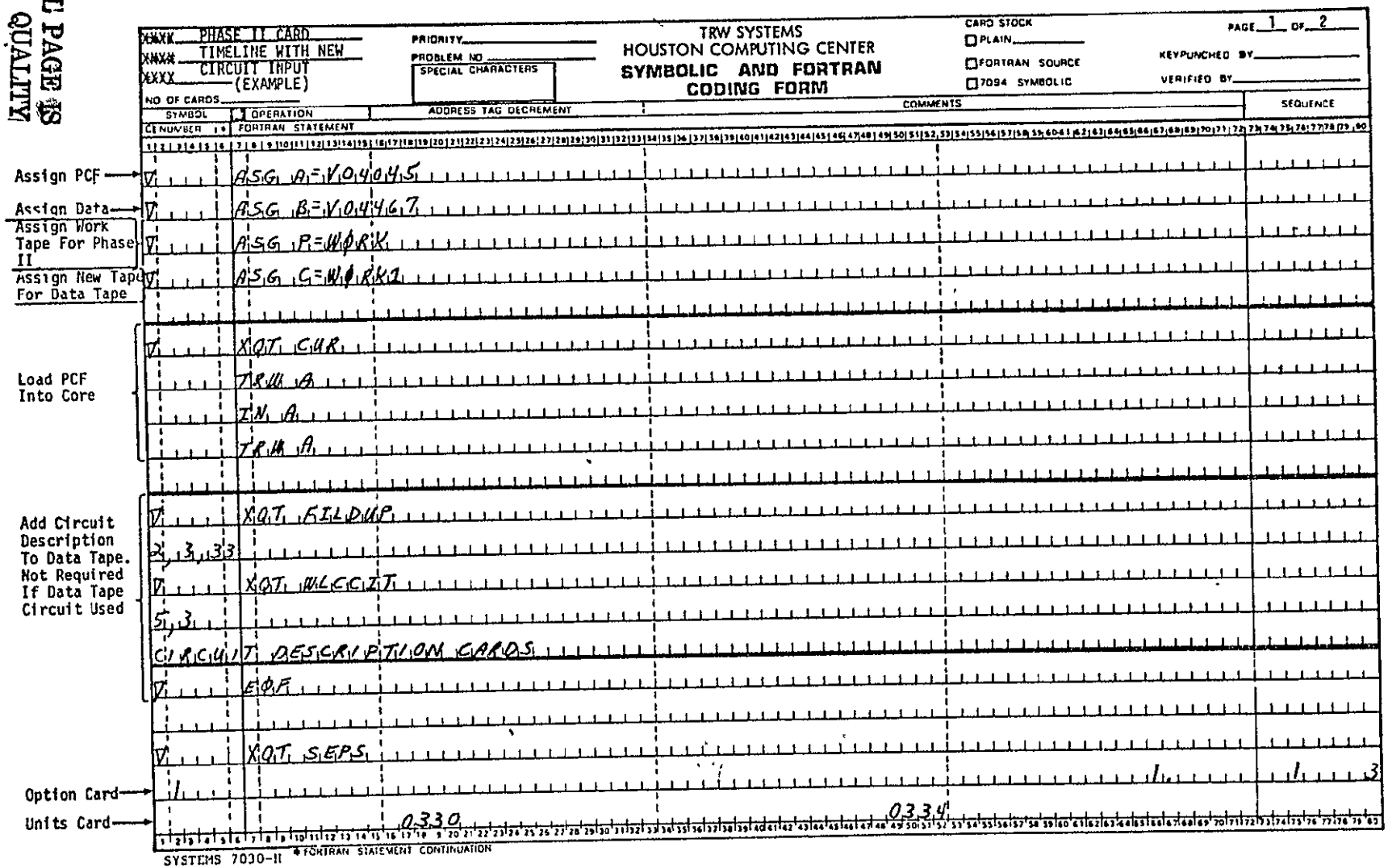
SYMBOL	OPERATION	ADDRESS TAG DECREMENT	COMMENTS	SEQUENCE
C NUMBER 1	FORTRAN STATEMENT			
	ASG A=A05769		Assign PCF	
	ASG B=V00SBS		Assign Data Tape	
	ASG F		Assign Fastrand for Timeline	
	ASG H=VSAVE		Assign Tape for Interface & Dig To be Saved	
	ASG I=VSAVE1		Assign Tape for plot to be saved	
	ASG G=WORK		Assign Working Tape for Phase I	
	XQT CAR			
	TRW A		Load PCF into Core	
	TM A			
	TRW A			
	XQT JUMPS			
68				
0221				
0201			Build Timeline	
0210	0510000			
0211	1990000			
0223	1600000			
	XQT SEPS			
1 1	1 111 1	1	Option Card	

SYSTEMS 7030-H *FORTRAN STATEMENT CONTINUATION



C-2

ORIGINAL PAGE IS
OF POOR QUALITY



APPENDIX D

ORIGINAL PAGE IS
OF POOR QUALITY

PHASE II CARD
~~TIMELINE WITH NEW~~
CIRCUIT INPUT
(EXAMPLE)

PRIORITY
PROBLEM NO.
SPECIAL CHARACTERS

TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN
CODING FORM

CARD STOCK
☐ PLAIN
☐ FORTRAN SOURCE
☐ 7094 SYMBOL C

PAGE 2 OF 2
KEYPUNCHED BY
VERIFIED BY

SYMBOL OR NUMBER	OPERATION / FORTRAN STATEMENT	ADDRESS TAG DECREMENT	COMMENTS	SEQUENCE
	1,7,90			
	$CARDS			
	VARIABLE DATA INPUT CARDS			
	$END			
	1,0			
	$CARDS		INPUT DATA FOR TIME POINT CHANGES	$
	9 EOF			

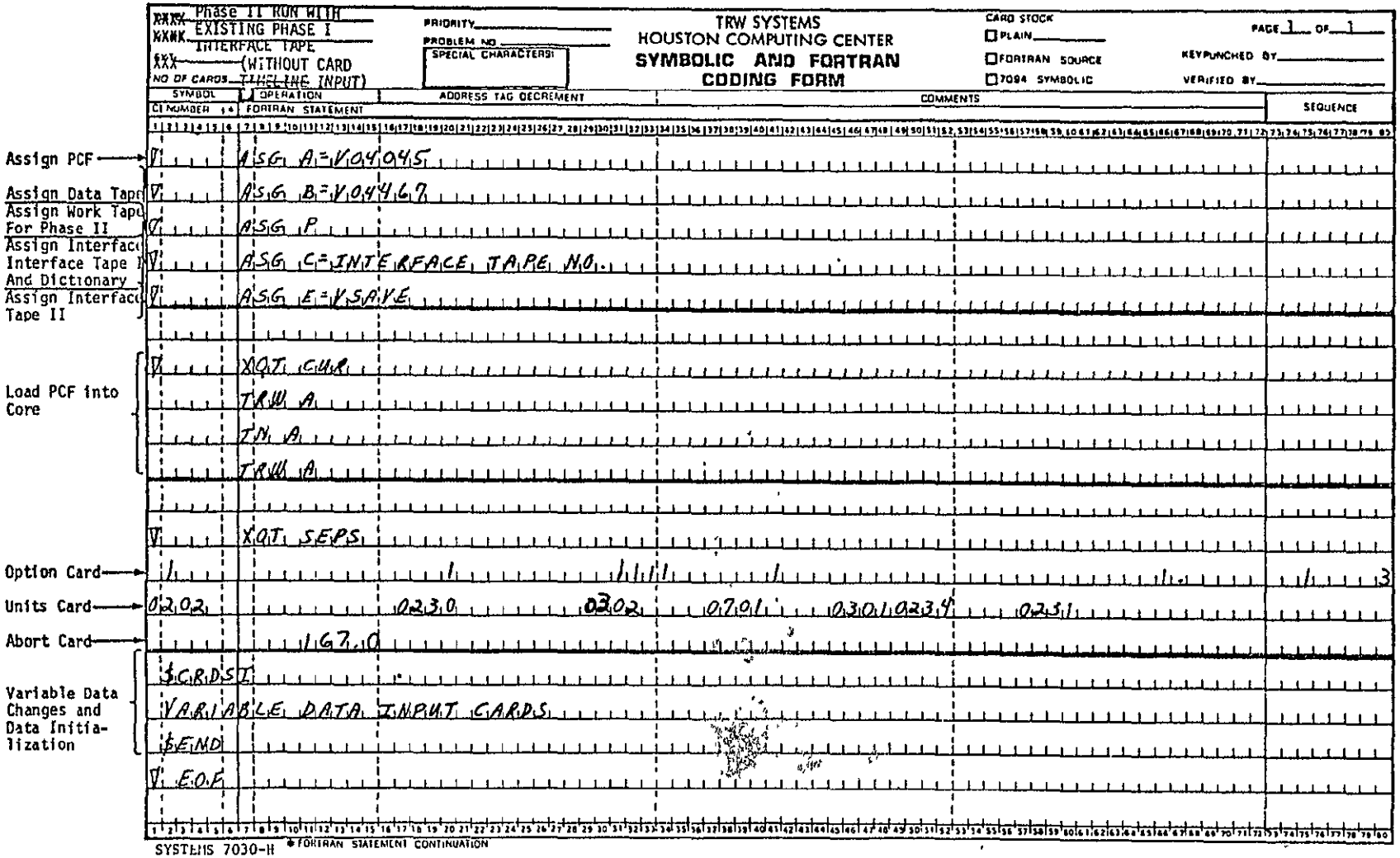
ABORT CARD

Variable Data Changes and Data Initialization

Timeline Inputs

SYSTEMS 7030-H ◆FORTRAN STATEMENT CONTINUATION

APPENDIX E


XXXX Phase II RUN WITH
XXXX EXISTING PHASE I
XXX INTERFACE TAPE
XXX (WITHOUT CARD
NO OF CARDS TIMELINE INPUT)
PRIORITY
PROBLEM NO
SPECIAL CHARACTERS
TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN
CODING FORM
CARD STOCK
PLAIN
FORTRAN SOURCE
7094 SYMBOLIC
PAGE 1 OF 1
KEYPUNCHED BY
VERIFIED BY
SYMBOL
OPERATION
ADDRESS TAG DECREMENT
COMMENTS
SEQUENCE
CI NUMBER
FORTRAN STATEMENT
ASG A=V04045
ASG B=V04467
ASG P
ASG C=INTERFACE TAPE NO.
ASG E=VSAVE
XQT CUR
TRW A
TM A
TRW A
XQT SEPS
0202 0230 0202 0701 0301 0234 0251
167.0
$CRDS
VARIABLE DATA INPUT CARDS
$END
E.O.F
Assign PCF
Assign Data Tape
Assign Work Tape For Phase II
Assign Interface Interface Tape I And Dictionary
Assign Interface Tape II
Load PCF into Core
Option Card
Units Card
Abort Card
Variable Data Changes and Data Initialization
SYSTEMS 7030-H
FORTRAN STATEMENT CONTINUATION

ORIGINAL PAGE IS
OF POOR QUALITY

XXX PHASE I/PHASE II RUN
XXXX WITHOUT CARD TIMELINE
EXT. INPUT (EXAMPLE)
NO OF CARDS

PRIORITY
PROBLEM NO
SPECIAL CHARACTERS

TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN CODING FORM

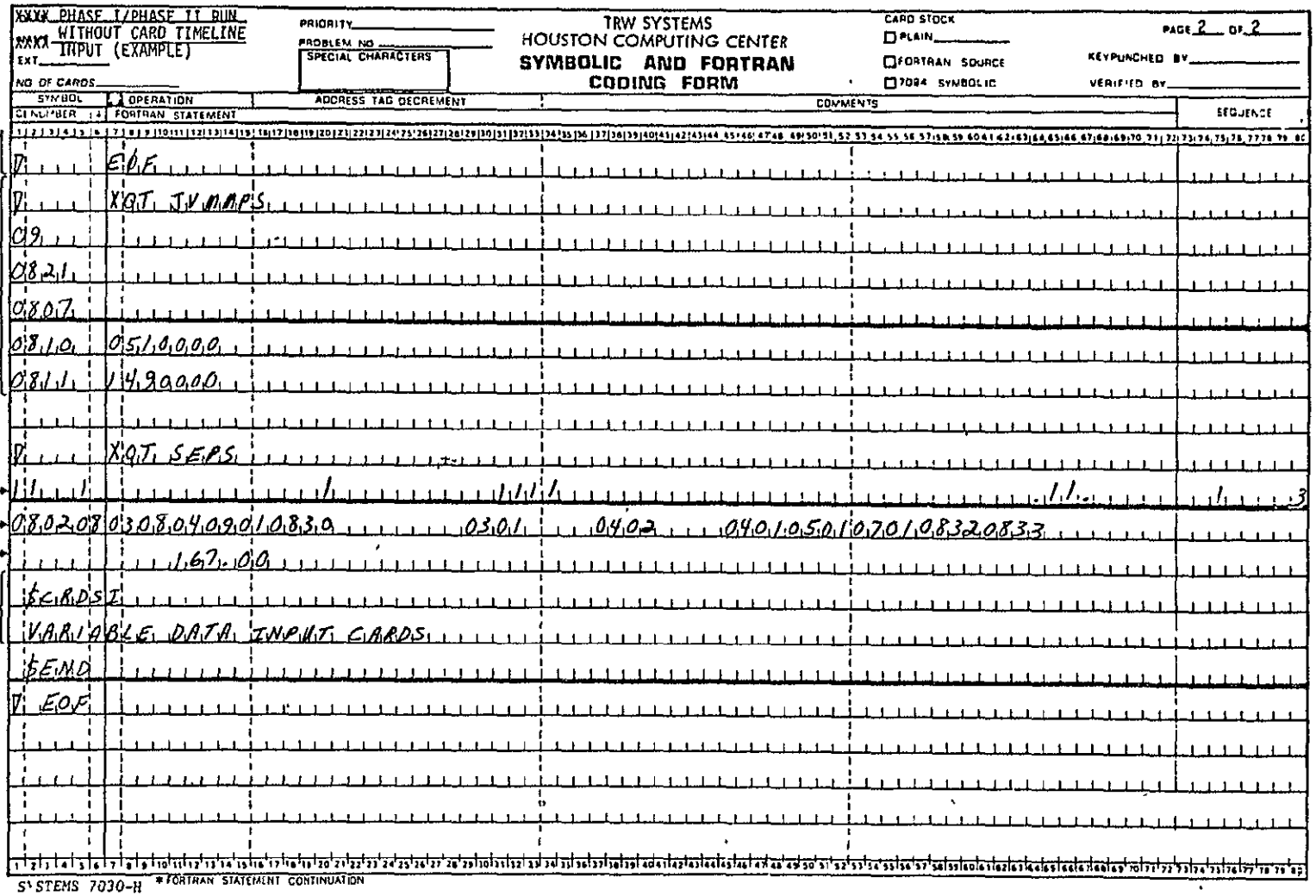
CARD STOCK
☐ PLAIN
☐ FORTRAN SOURCE
☐ 7094 SYMBOLIC

PAGE 1 OF 2
KEYPUNCHED BY
VERIFIED BY

SYMBOL	OPERATION	ADDRESS TAG DECREMENT	COMMENTS	SEQUENCE
NUMBER	FORTRAN STATEMENT			

Assign PCF	V	ASG A=V04045
Assign Data Tape	V	ASG B=V04467
Assign Work Tape For Phase I	V	ASG C=WORK
Assign Work Tape For Phase II	V	ASG P
Assign Interface Tape I And Dictionary	V	ASG C=WORK1
Assign For Interface Tape II	V	ASG D=VSAVE
Assign Constraints	V	ASG E=WORK2
Assign New Data Tape	V	ASG F=VSAVE1
Assign Timeline Tape	V	ASG G=WORK3
Load PCF Into Core	V	XQT CUR
		TRN A
		IN A
		TRN A
Add Circuit Description To Data Tape. Not Required If Data Tape Circuit is Used.	V	XQT FILDUP
	2,8,3,3	
	V	XQT WLCCIT
	5,8	
		CIRCUIT DESCRIPTION CARDS

SYSTEMS 7030 II * FORTRAN STATEMENT CONTINUATION


XXXX PHASE I/PHASE II RUN
XXXX WITHOUT CARD TIMELINE
EXT
INPUT (EXAMPLE)
NO OF CARDS
PRIORITY
PROBLEM NO
SPECIAL CHARACTERS
TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN
CODING FORM
CARD STOCK
PLAIN
FORTRAN SOURCE
7094 SYMBOLIC
PAGE 2 OF 2
KEYPUNCHED BY
VERIFIED BY
SYMBOL
OPERATION
ADDRESS TAG DECREMENT
COMMENTS
SEQUENCE
FORTRAN STATEMENT
EOF
XQT JVMMPS
XQT SEPS
$CARDS
VARIABLE DATA INPUT CARDS
$END
EOF
Build Timeline With JVMMPS
Option Card
Units Card
Abort Card
Variable Data Changes and Data Initialization
SYSTEMS 7030-H
*FORTRAN STATEMENT CONTINUATION

APPENDIX F

XXXX PHASE II RUN WITH
XXXX EXISTING PHASE I
EXT INTERFACE TAPE AND
NO OF CARDS CARD TIMELINE INPUT (EXAMPLE)

PRIORITY
PROBLEM NO
SPECIAL CHARACTERS

TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN CODING FORM

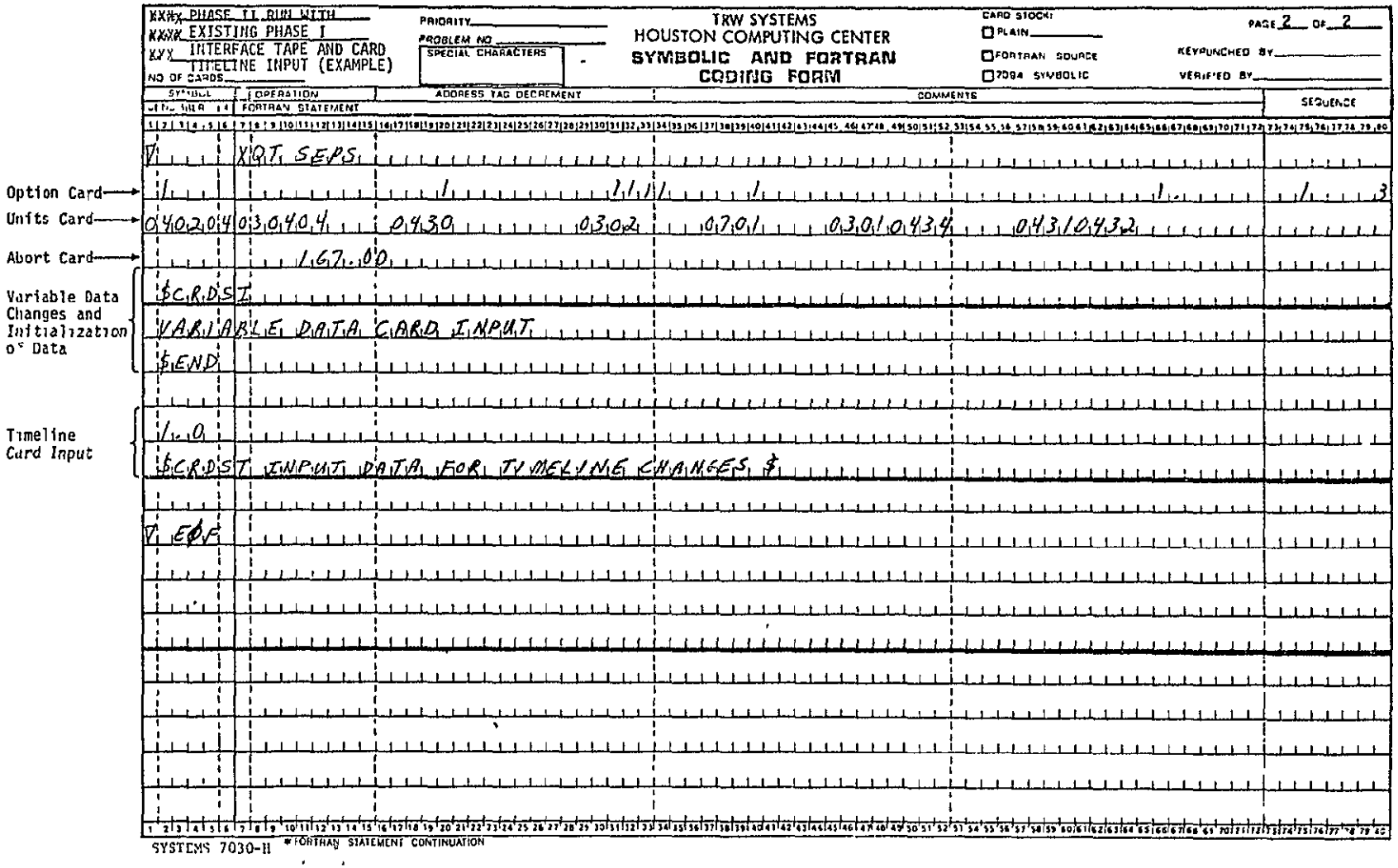
CARD STOCK
☐ PLAIN
☐ FORTRAN SOURCE
☐ 7094 SYMBOLIC

KEYPUNCHED BY
VERIFIED BY

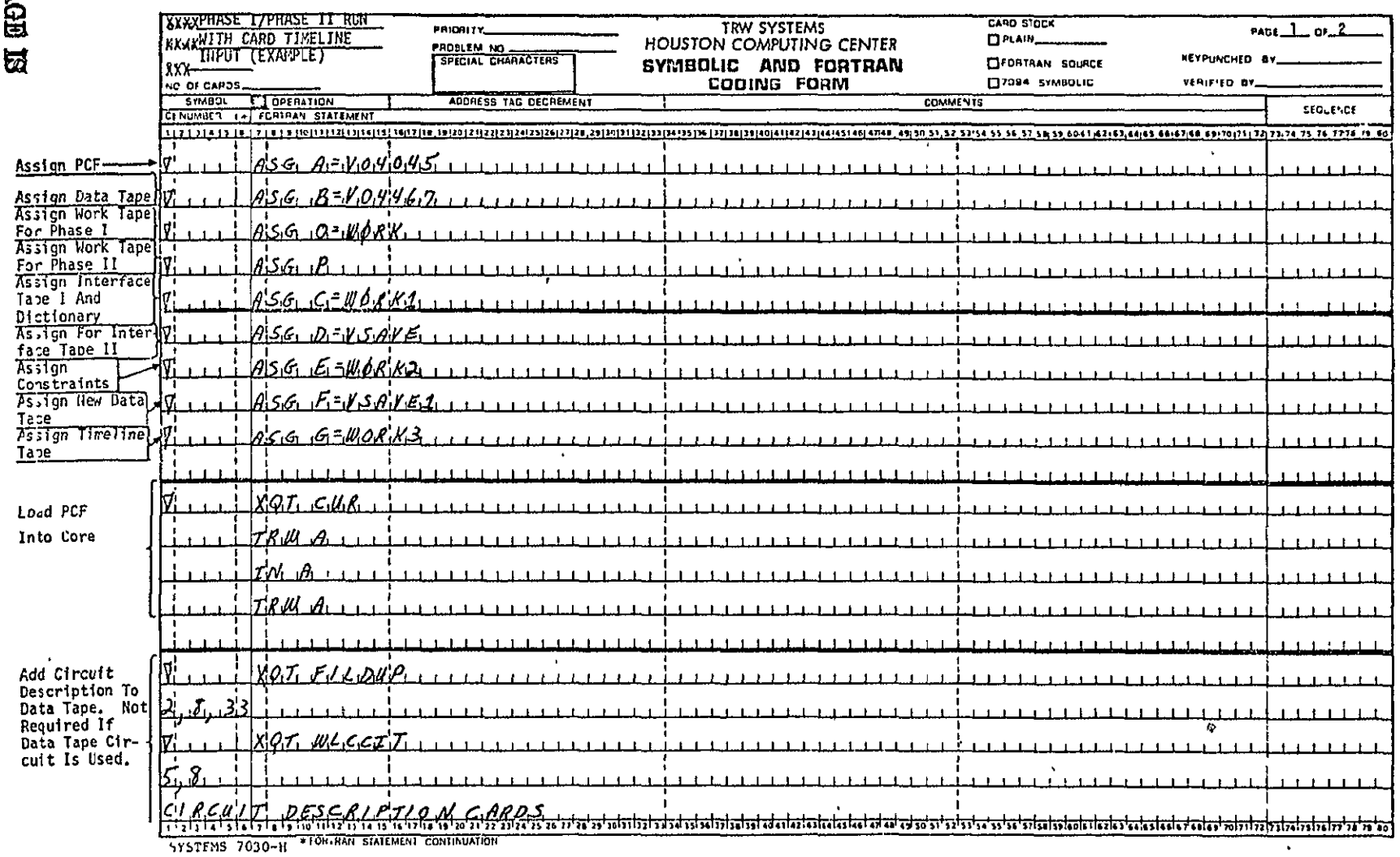
SYMBOL	OPERATION	ADDRESS TAG DECREMENT	COMMENTS	SEQUENCE
C NUMBER	FORTRAN STATEMENT			

Assign PCF	ASG A=V0H4045	
Assign Data Tape	ASG B=V0H4162	
Assign Work Tape For Phase II	ASG P=WORK	
Assign Interface Tape I And Dictionary	ASG C=INTERFACE TAPE NO.	
Assign New Data Tape	ASG D=VSAVE	
Assign Interface Tape II	ASG E=VSAVE2	
Load PCF Into Core	XQT CUR	
	TRW A	
	IN A	
	TRW A	
Adding Circuit Description To Data Tape, Not Recuired If Data Tape Circuit Is Used.	XQT FILDMP	
	2,4,3,3	
	XQT WLCCIT	
	5,4	
	CIRCUIT DESCRIPTION CARDS	
	EOF	

SYSFMS 7030-H * FORTRAN STATEMENT CONTINUATION


XXXX PHASE II RUN WITH
XXXX EXISTING PHASE I
XXX INTERFACE TAPE AND CARD
TIMELINE INPUT (EXAMPLE)
NO OF CARDS
PRIORITY
PROBLEM NO
SPECIAL CHARACTERS
TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN
CODING FORM
CARD STOCK:
PLAIN
FORTRAN SOURCE
7094 SYMBOLIC
PAGE 2 OF 2
KEYPUNCHED BY
VERIFIED BY
SYMBOL
OPERATION
ADDRESS TAG DECREMENT
COMMENTS
SEQUENCE
FORTRAN STATEMENT
V XQT SEPS
Option Card
1 1 1,1,1,1 1 1 1 1
Units Card
0402014 0304041 0430 0302 0701 0301043 4 0431043 2
Abort Card
1,67.00
Variable Data Changes and Initialization of Data
$CRDST
VARIABLE DATA CARD INPUT
$END
Timeline Card Input
1.0
$CRDST INPUT DATA FOR TIMELINE CHANGES $
V EOF
SYSTEMS 7030-H
* FORTRAN STATEMENT CONTINUATION

F-2



XXXPHASE I/PHASE II RUN
KKKWITH CARD TIMELINE
XXX INPUT (EXAMPLE)
NO OF CARDS

PRIORITY
PROBLEM NO
SPECIAL CHARACTERS

TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN
CODING FORM

CARD STOCK
☐ PLAIN
☐ FORTRAN SOURCE
☐ 7094 SYMBOLIC

PAGE 1 OF 2
KEYPUNCHED BY
VERIFIED BY

SYMBOL	OPERATION	ADDRESS TAG DECREMENT	COMMENTS	SEQUENCE
C NUMBER	FORTRAN STATEMENT			

Assign PCF	ASG A=V,04,045	
Assign Data Tape	ASG B=V,04,46,7	
Assign Work Tape For Phase I	ASG C=WORK	
Assign Work Tape For Phase II	ASG D	
Assign Interface Tape I And Dictionary	ASG C=WORK1	
Assign For Interface Tape II	ASG D=VSAVE	
Assign Constraints	ASG E=WORK2	
Assign New Data Tape	ASG F=VSAVE1	
Assign Timeline Tape	ASG G=WORK3	
Load PCF Into Core	XQT CWR	
	TRW A	
	IN B	
	TRW A	
Add Circuit Description To Data Tape. Not Required If Data Tape Circuit Is Used.	XQT FILDUP	
	2,8,33	
	XQT WLCCIT	
	5,8	
	CIRCUIT DESCRIPTION CARDS	

SYSTEMS 7030-H *FORTRAN STATEMENT CONTINUATION

XXX PHASE I/PHASE II RUN
XXX WITH CARD TIMELINE
XXXX INPUT (EXAMPLE)
XX

NO OF CARDS

PRIORITY

PROBLEM NO

SPECIAL CHARACTERS

TRW SYSTEMS
HOUSTON COMPUTING CENTER
SYMBOLIC AND FORTRAN CODING FORM

CARD STOCK
☐ PLAIN
☐ FORTRAN SOURCE
☐ 7094 SYMBOLIC

PAGE 2 OF 2

KEYPUNCHED BY

VERIFIED BY

SYMBOL / CARD NUMBER | OPERATION / FORTRAN STATEMENT | ADDRESS TAG DECREMENT | COMMENTS | SEQUENCE

Build Timeline With JVMMPS:

```
∇     EØF
∇     XQT JVMMPS
09
0821
0807
0810  0510000
0811  1490000
```

```
∇     XQT SEPS
```

Option Card →
```
11  1       1         1111                        11        1    3
```

Units Card →
```
080208030804090108 30        0301    0402    04010501 0701083 20833
```

Abort Card →
```
          167 00
```

Variable Data Changes And Data Initialization:

```
 $CRDST
 VARIABLE DATA INPUT CARDS
 $END
```

Timeline Inputs:

```
 1.0
 $CRDST INPUT DATA FOR TIMELINE CHANGES $
∇ EØF
```

SYSTEMS 7030-H *FORTRAN STATEMENT CONTINUATION

APPENDIX G

PROGRAM:

CIFLIS

PURPOSE:

This program is used to list a given number of files from a card image tape.

USER GUIDE:

The input deck set-up consists of the execute card and a units card. The units card utilizes free field format, the first variable is the physical unit designation of where the tape is mounted and the second variable tells how many files are to be printed.

PROGRAM:

CMPDAT

PURPOSE:

This program is used to give a component and/or mission phase comparison of two interface tapes.

USER GUIDE:

The input deck set-up consists of the execute card, a units card, and a time frame definition card. Both the units card and the time frame definition card utilize fixed formats.

COMPARISON PROGRAM INPUT (CMPDAT)

Unit Definition Card

COLUMNS		PURPOSE
1-2	Unit	Standard Interface
3-4	File	
5-6	Unit	Comparison Interface
7-8	File	
9-10	Unit	Component Dictionary
11-12	File	
13-14	Unit	Compact Dictionary
15-16	File	
17-18	Unit	Subsystem Names
19-20	File	
21-22	Unit	Mission Phase Definitions
23-24	File	
25-30		Blank
31-40		Standard Inverter Efficiency
41-50		Comparison Inverter Efficiency
51-60		Standard Line Loss
61-70		Comparison Line Loss
71		Mission Phase Analysis Flag

Time Frame Definition Card

1-10	Standard Analysis Start Time
11-20	Standard Analysis End Time
21-30	Standard Analysis Delta Shift
31-40	Comparison Analysis Start Time
41-50	Comparison Analysis End Time
51-60	Comparison Analysis Delta Time

PROGRAM:

CREDJR

PURPOSE:

This program is used to make changes to the component definition card image tape file.

USER GUIDE:

The input deck set-up consists of the execute card, a units card, and a set of component change cards. The units card utilizes free field format and contains, first the input physical unit designation and secondly the output physical unit designation. The component change cards utilize a fixed format, obviously the same format as the component definition cards. The user inputs the component number, mode, and the new information in its correct field location. Any change to a field changes the complete field, i.e., it is not column or character replacement.

PROGRAM:

FILDUP

PURPOSE:

This program is used to duplicate card image files.

USER GUIDE:

The input deck set-up consists of the execute card and a set of units cards. The units cards utilize free field format. The first variable is the input physical unit designation, the second is the output physical unit designation, and the third is the number of files to be duplicated.

PROGRAM:

JVMMPS

PURPOSE:

This program is used to concatenate several timeline files together and to time order the resulting file.

USER GUIDE:

The input deck set-up consists of the execute card, a units card, and a set of file definition cards. The units card utilizes free field format and contains the physical unit designation of the output unit. The file definition cards utilize a fixed format:

Column	Purpose
1-2	Input physical unit designation
3-4	File number
5-9	Delta hours
10-11	Delta minutes
12-13	Delta seconds

The delta times are used to shift the file times into the required time frame.

PROGRAM:

NEWHLP

PURPOSE:

This program is used to construct a tape able to be plotted showing user designated component's time history of operation.

USER GUIDE:

The input deck set-up consists of the execute card, a units card, and a set of component cards. The units card utilizes free field format and consists of eight variables:

1 Physical unit designation of the compact component dictionary

2 File number

3 Physical unit designation of the timeline

4 File number

5 Physical unit designation of the plot tape

6 Print flag

= 0 Print time history of component operation

> 0 Suppress print

7 Analysis start time

8 Analysis stop time

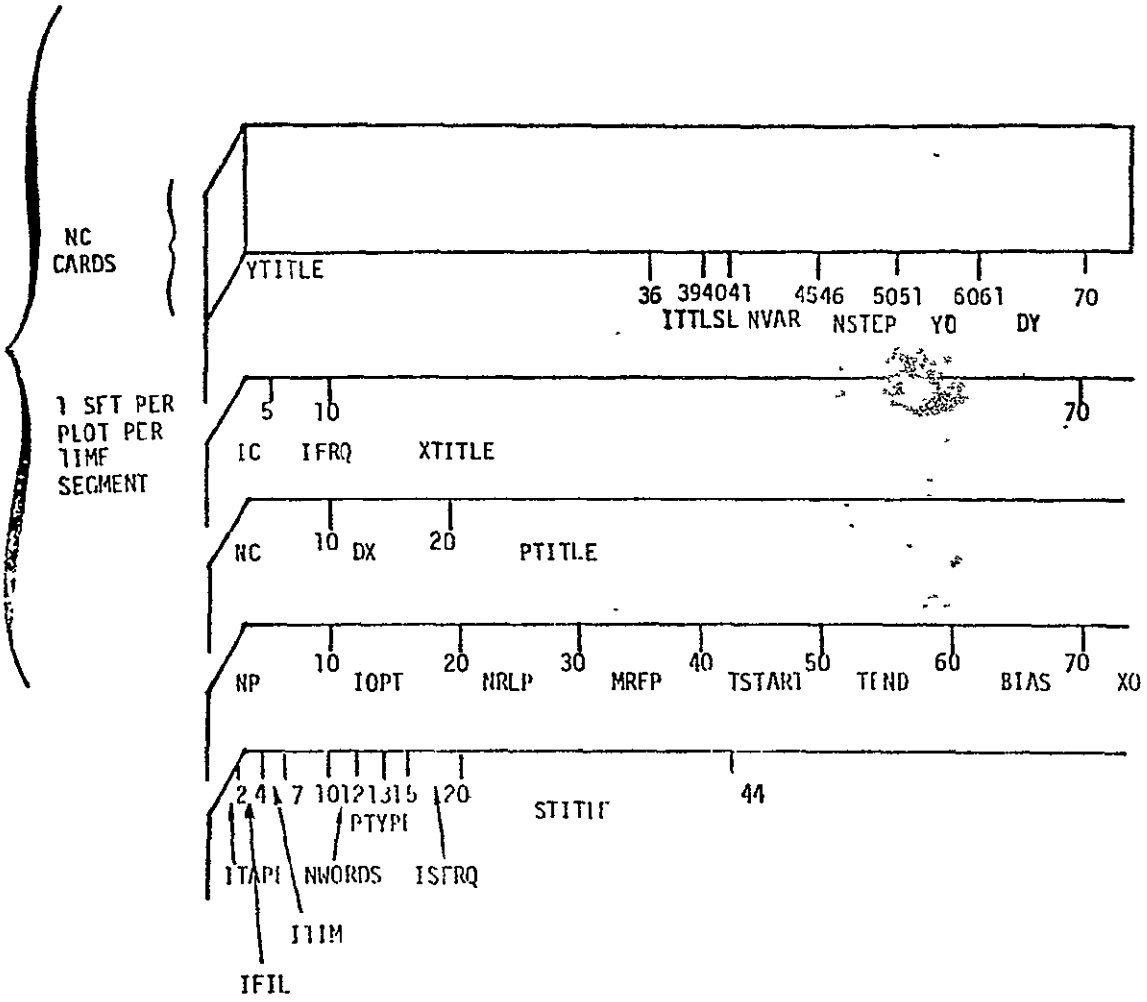
The component cards utilize free field format and contain the component identification of the components to be analyzed.

PROGRAM:

STLPLT

PURPOSE:

Generate CalComp plots Mission Phase I or Phase II Plot tapes.



STLPLT CARD DECK SETUP

STLPLT CARD 1

CARD 1 (One Card Per Execution)

COL	JUSTIFICATION	VARIABLE	DESCRIPTION
1-2	r	ITAPE	Input tape unit
3-4	r	IFIL	File no.
5-7	r	ITIM	Word location of time
8-9			Blank
10-12	r	NWORDS	Number of words per logical record
13	r	PTYPE	Type of paper form plot is to appear on A- 10 inch by up to 41 inches of blank vellum B- 10 inch by up to 41 inches of continuous grid C- 7 inch by 10 inch of grid D- 10 inch by 15 inch of grid If no choice is made STLPLT assumes form Type B is to be used.
14-15			Blank
16-20	r	ISFRQ	Standard frequency of symbol appearance ISFRQ>0 symbol appearance every ISFRGth point ISFRQ=0 symbol frequency of appearance every 20^{th} point ISFRQ<0 point plot is to be made
21-44	L	STITLE	Standard message to appear on all plots

STLPLT CARD 2

CARD 2 (One Card Per Time Segment)

COL	JUSTIFICATION	VARIABLE	DESCRIPTION
1-10	r	NP	Number of plots this time segment
11-20	r	IOPT	Word location of the independent variable
21-30	r	NREP*	Number of first repeated time segment to be plotted
31-40	r	MREP*	Number of last repeated time segment to be plotted
41-50	r	TSTART	Starting time of segment to be plotted
51-60	r	TEND	Ending time of segment to be plotted
61-70	r	BIAS	X-axis bias factor
71-80	r	XO	Time to appear as start of the X-axis
		* If	this option is not used, this value may be omitted

CARD 3 (One Card Per Plot)

STLPLT CARD 3

COL	JUSTIFICATION	VARIABLE	DESCRIPTION
1-10	r	NC	Number of traces this plot
11-20	r	DX	X-axis scale delta factor per inch
21-80	L	PTITLE	Plot title

Card 4 (One Per Plot)

STLPLT CARD 4

...	JUSTIFICATION	VARIABLE	DESCRIPTION
1-5	r	IC	Flag used, if value is nonzero, to override internal X-axis title
6-10	r	IFRQ	Symbol appearance frequency this plot if this value is zero standard frequency is used
11-70	L	XTITLE	X-axis title, if IC has a nonzero value this variable is used as the X-axis title

CARD 5 (One Card Per Trace)

STLPLT CARD 5

COL	JUSTIFICATION	VARIABLE	DESCRIPTION
1-36	L	YTITLE	Y-axis title this trace
37-38			Blank
39-40	r	ITTLSL	Y-axis title and scale suppress ITTLSL = 0 no suppress = 1 suppress scale only = 2 suppress both scale and title
41-45	r	NVAR	Index of the variable to be plotted this trace
46-50	r	NSTEP	Step function flag for this trace Value<0 indicates continuous trace Value≥0 indicates step function trace
51-60	r	YO	Y-axis scale initial point
61-70	r	DY	Y-axis delta factor per inch For any negative or zero values the program will compute a Y-axis scale

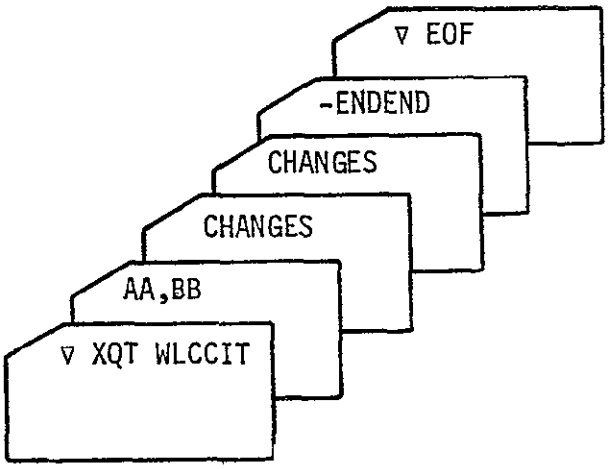
PROGRAM:

WLCCIT

PURPOSE:

This program is used to create or alter a card image tape file, as a by product the file is listed and each entry is numbered.

WLCCIT



Card 1: Execution Card

Card 2: Units Card

Col. 1-2: Unit where old tape to be changed is located or card reader unit

Col. 3: Comma

Col. 4-5: Unit where new or changed tape is located

Card 3 N-2: Changes -

Card 3: Line # where change is to be made and/or after which new data is to be inserted. (Line # not required when making new tape from cards)

-X, Y Card for Line Change and/or data insertion

-X, Card for data insertion only

Card 4 N-1: New or Changed Data

Card N : -ENDEND

WLCCIT is the machine equivalent to physically removing data cards and replacing these cards with new data or simply adding new data.

Change Card E.g.'s:

To delete data:

Card 4: - 10, 15 : Starting with Line 10, delete all information up to & including Line 15

To delete data and add data:

Card 4: - 10, 15 Followed by data to be inserted. Deletes lines 10 15 inclusive and inserts new data.

To add data:

Card 4: - 10, Followed by data cards.

Inserts new data after line addressed on Card 1.